

Exploring the Relationship between Self-Efficacy, Physical Activity, and Cardiovascular Disease  
Risk in Women at Moderate to High Risk for Cardiovascular Disease

By

Lisa Banman

A Thesis submitted to the Faculty of Graduate Studies of  
The University of Manitoba  
in partial fulfillment of the requirements of the degree of

MASTER OF NURSING

College of Nursing, Rady Faculty of Health Sciences  
University of Manitoba  
Winnipeg

Copyright 2018 © Lisa Banman

## ABSTRACT

**Background:** Women face significant threat from cardiovascular disease (CVD), and this threat increases with age, particularly in the menopausal years. Physical activity (PA) has been shown to reduce the risk of CVD in women; furthermore, self-efficacy has been identified as a strong predictor of whether a woman will engage in this health behavior. **Purpose:** To explore the relationship between women's risk for CVD and self-efficacy beliefs in relation to the behavior of physical activity. **Methods:** The Health Promotion Model was used to guide the retrospective, cross-sectional study. The sample (n=120) included participants from the Happy Hearts Health Promotion Program (HHHPP), an intervention study aimed at improving cardiovascular risk in women at moderate to high risk for CVD. Baseline data was analyzed using descriptive, bivariate, and multivariate analyses. **Results:** On average, the women in this sample were 68 years old, overweight, highly educated, and highly active. Bivariate analyses revealed no significant correlation between cardiac risk and self-efficacy, but a positive correlation was identified between BMI and frailty, and a general decline in walking activity (6MWT) with increasing age. In regression analysis, frailty emerged as a significant predictor of the total and subtypes of Multidimensional Self-Efficacy ( $R^2= 2.9\%-11\%$ ). Although several activity and self-reported measures were significantly correlated in the bivariate analysis, moderate self-reported physical activity and the 6MWT were the only activity measures to significantly predict any of the self-efficacy variables. There was no significant relationship between self-efficacy measures and outcome expectations. **Discussion:** Nurses are ideally positioned to lead health promotion initiatives, such as evidence based exercise self-efficacy enhancing interventions and educational strategies for aging women that focus on the importance of physical activity in reducing the risk of CVD and frailty. As a holistic approach is central to nursing, it is important for nurses to incorporate the components of self-efficacy, frailty, and CVD risk into their assessments and ongoing care of aging female patients. **Significance:** This study provides novel research evidence regarding the influence of frailty on the exercise self-efficacy of aging women at risk for heart disease. This study also contributes to existing research on the significant interaction between self-efficacy and physical activity in women; furthermore, the findings support emerging data related to the relationship between BMI and frailty. This research establishes foundational evidence for future nursing research aimed at strengthening the exercise self-efficacy beliefs of aging women with the goal of improving physical activity to reduce CVD and frailty risk.

## ACKNOWLEDGMENTS

This thesis project would not have been possible without the significant contributions of the following individuals:

**Dr. Jo-Ann Sawatzky (committee chair):** Thank you for all that you have taught me about writing and research over the last 5 years. This has been a challenging journey but I am so grateful for your patience and perseverance in seeing me through to the end!

**Dr. Todd Duhamel (external committee member):** Thank you for allowing me to participate in your research project and for letting me use some of the data to conduct my analysis. I have appreciated your external perspective, you have challenged me to substantiate the nursing role and this has strengthened my paper.

**Dr. Lorraine Avery (internal committee member):** Thank you for sharing your clinical expertise with me, I have appreciated your support throughout this project.

**Brett Hiebert (statistician):** Thank you for guiding my statistical analysis. I have truly appreciated your ability to explain statistics in a way that I could understand.

**David Kent (project manager for the Happy Hearts Study):** Thank you for teaching me about data collection and for being patient with all of my questions.

**James Plohman and the MCNHR:** Thank you for helping me navigate SPSS, and for helping with the formatting of my paper.

**The Happy Hearts Participants:** I would like to acknowledge the women who participated in this study. During the year of data collection, I was privileged to spend time with this group of inspiring women who embraced life and wanted to give back to their community through their involvement in this research. Thank you for your contribution to improving women's cardiovascular health!

## DEDICATION

I dedicate this thesis project to my family,  
who waited a long time for “mommy to finish her big paper.”

To my husband Chris:  
thank you for being patient and kind with me,  
I could not have done this without your love and support.

To my children William, Isla, & Katherine:  
coming home to you is the best part of every day,  
and I can’t wait to spend more time together!

“Life is not easy for any of us.

But what of that?

We must have perseverance and above all confidence in ourselves.

We must believe that we are gifted for something and that this thing must be attained.”

-Marie Currie

## TABLE OF CONTENTS

<b>ABSTRACT</b> .....	<b>ii</b>
<b>ACKNOWLEDGMENTS</b> .....	<b>iii</b>
<b>DEDICATION</b> .....	<b>iv</b>
<b>LIST OF TABLES</b> .....	<b>ix</b>
<b>LIST OF FIGURES</b> .....	<b>x</b>
<b>CHAPTER ONE: STATEMENT OF THE PROBLEM</b> .....	<b>11</b>
<b>Cardiovascular Disease</b> .....	<b>12</b>
Burden of Cardiovascular Disease .....	13
Women and cardiovascular disease .....	14
<b>Health Promotion</b> .....	<b>14</b>
History of Cardiovascular Health Promotion .....	15
Heart Health Promotion in Women at Risk .....	16
Physical Activity and Heart Health Promotion .....	17
Self-Efficacy.....	18
<b>Purpose of the Study</b> .....	<b>18</b>
<b>Research Questions</b> .....	<b>19</b>
<b>Study Significance</b> .....	<b>19</b>
<b>Summary</b> .....	<b>20</b>
<b>CHAPTER TWO: THEORETICAL FRAMEWORK</b> .....	<b>21</b>
The Social Cognitive Theory .....	21
<b>Disease Prevention versus Health Promotion</b> .....	<b>23</b>
<b>The Health Belief Model</b> .....	<b>25</b>
Background .....	26
Components of the Health Belief Model.....	27
Strengths and Limitations of the Health Belief Model .....	29
<b>Health Promotion Model</b> .....	<b>30</b>
Background .....	30
<b>Components of the Health Promotion Model</b> .....	<b>31</b>
Individual Characteristics and Experiences .....	32
Behavior-Specific Cognitions and Affect .....	33
Strengths and Limitations of the Health Promotion Model .....	35
<b>Summary</b> .....	<b>37</b>

<b>Definition of Terms</b> .....	<b>38</b>
<b>CHAPTER THREE: REVIEW OF THE LITERATURE</b> .....	<b>39</b>
<b>Background</b> .....	<b>39</b>
<b>Review of the Literature</b> .....	<b>42</b>
Individual Characteristics and Experiences .....	42
Personal Factors .....	43
Sex .....	43
Age.....	47
Body mass index.....	48
Frailty.....	49
Frailty and cardiovascular disease .....	50
Prior Related Behavior .....	51
Behavior Specific Cognitions and Affect .....	53
Perceived Benefits of Action.....	54
Perceived Barriers to Action .....	55
Perceived Self-Efficacy.....	56
Self-efficacy in health promotion .....	57
Self-efficacy in health promotion in cardiovascular disease. ....	57
Self-efficacy in women at risk for cardiovascular disease.....	58
Self-efficacy in populations with cardiovascular disease .....	59
Exercise self-efficacy.....	60
<i>Measuring self-efficacy.</i> .....	61
Self-efficacy and key study variables .....	63
<i>Self-efficacy and age.</i> .....	64
<i>Self-efficacy and body mass index.</i> .....	64
<i>Self-efficacy and outcome expectations of physical activity.</i> .....	66
<b>Behavioral Outcomes</b> .....	<b>69</b>
Physical Outcomes .....	69
Social Outcomes.....	71
Psychological Outcomes .....	72
<b>Summary</b> .....	<b>73</b>
<b>CHAPTER FOUR: METHODOLOGY</b> .....	<b>74</b>
<b>Research Design</b> .....	<b>74</b>
<b>The Sample</b> .....	<b>74</b>
<b>Measurement Instruments</b> .....	<b>75</b>
<b>Measuring Self-Efficacy</b> .....	<b>75</b>
Self-Efficacy.....	75

Measuring Exercise Self-efficacy .....	76
Measuring cardiovascular disease risk.....	77
Measuring Physical Activity .....	80
Measuring Fitness .....	81
Measuring Outcome Expectations. ....	83
Measuring demographic and personal factors .....	84
Measuring frailty .....	84
<b>Data Collection Procedures.....</b>	<b>84</b>
<b>Data Analysis Plan .....</b>	<b>85</b>
Ethical Considerations.....	85
Summary .....	86
<b>CHAPTER FIVE: RESULTS.....</b>	<b>87</b>
Data Collection and Analysis.....	87
<b>Description of Sample.....</b>	<b>87</b>
Individual Characteristics and Experiences .....	87
<b>Summary.....</b>	<b>109</b>
<b>CHAPTER 6: DISCUSSION .....</b>	<b>110</b>
<b>The Health Promotion Model .....</b>	<b>110</b>
Individual Characteristics and Experiences .....	110
Personal factors.....	110
Past Behaviors: Physical Activity and Physical Fitness.....	117
Behavior-specific Cognitions and Affect.....	121
Age and self-efficacy.....	123
Frailty and self-efficacy.....	124
BMI and self-efficacy .....	126
Physical measures and self-efficacy .....	126
Summary .....	131
<b>Implication and Recommendations.....</b>	<b>132</b>
Clinical Nursing Practice .....	132
Nursing Education.....	135
Nursing Research .....	136
Conceptual Framework .....	139
Limitations of the Study .....	139
<b>Chapter Summary .....</b>	<b>140</b>
<b>Thesis Summary and Conclusion .....</b>	<b>141</b>
<b>References .....</b>	<b>144</b>

**LIST OF APPENDICES ..... 193**

**LIST OF TABLES**

Table 1	Descriptive Statistics: Continuous Variables of Individual Characteristics	88
Table 2	Descriptive Statistics: Categorical Variables of Individual Characteristics	89
Table 3	Distribution of Rasmussen Disease Score by Age Category	89
Table 4	Distribution of Frailty Scores by Age Categories	90
Table 5	Distribution of Body Mass Index by Age Category	92
Table 6	Distribution of Self-Reported Physical Activity by Age Groups	95
Table 7	Distribution of 6MWT (meters) by Age Group	96
Table 8	Distribution of Self-Efficacy Scores by Age Group	97
Table 9	Study Variables: Correlation Analysis	99
Table 10	Factors Associated with General Self-Efficacy: Regression Analysis	100
Table 11	Factors Associated with Multidimensional Self-Efficacy: Regression Analysis	101
Table 12	Factors Associated with Multidimensional Task Self-Efficacy: Regression Analysis	102
Table 13	Factors Associated with Multidimensional Barrier Self-Efficacy: Regression Analysis	103
Table 14	Factors Associated with Multidimensional Scheduling Self-Efficacy: Regression Analysis	104
Table 15	Factors Associated with Multidimensional Barrier Self-Efficacy: Outcome Expectations	108

**LIST OF FIGURES**

Figure 1	The Self-Efficacy Model	22
Figure 2	Multidimensional Self-Efficacy for Physical Activity Behavior	24
Figure 3	The Health Belief Model	25
Figure 4	The Health Promotion Model	30
Figure 5	A Modified Diagram of the Health Promotion Model	31
Figure 6	Distribution of Frailty Phenotypes by Age Group	91
Figure 7	Weight Range According to Body Mass Index by Age Group	92
Figure 8	Distribution of Frailty Categories vs Weight Categories by Age Group	93

## CHAPTER ONE: STATEMENT OF THE PROBLEM

Although once considered a man's disease, more women than men are now living and dying with cardiovascular disease (CVD; Mosca, Barrett-Connor, & Wenger, 2011). An estimated one in two women will be affected by heart disease during their lifetime (Wenger, 2015); moreover, with longer life expectancies, women are making up a growing proportion of the aging population in which the incidence of CVD is the highest (Duncan et al., 2011). Unfortunately, women who are diagnosed with CVD also have poorer outcomes than men (Mozaffarian et al., 2016). Hence, it is clear that women are at particular risk for CVD and efforts must be made to reduce this threat.

CVD mortality rates have been declining in recent years due to health promotion initiatives, such as regular physical activity (PA) and healthy eating (Buttar, Yan, Taggart, & Tian, 2017; Ong, Lovasi, Madsen, Van Wye, & Demmer, 2017). These types of activities reduce modifiable risk factors for CVD, including sedentary lifestyle, obesity, diabetes, stress, high blood pressure, and high cholesterol (Heart and Stroke Foundation [HSF], 2017). In fact, 80% of premature CVD can be prevented through the adoption of healthy lifestyle behaviors (Centers for Disease Control [CDC], 2017). Thus, health promotion has emerged as an important strategy to reduce the threat of heart disease, with national organizations such as the HSF and the American Heart Association (AHA) recently shifting their focus from preventing heart disease to the promotion of cardiovascular health (HSF, 2017; Hsu & Wong, 2017). It follows that the promotion of women's cardiovascular health must become a priority for the future.

Although physical activity is central to health promotion, half of all Canadians are physically inactive (Warburton, Nicol, & Bredin, 2006). Importantly, women are less likely than men to meet the recommended physical activity guidelines (Canadian Society for Exercise

Physiology, 2013), which contributes to their particularly high risk for CVD. Self-efficacy has been identified as an important determinant of healthy behavior, including physical activity; however, most research in this area has been done on men of all ages and younger women. An understanding of the relationship between self-efficacy beliefs for exercise, physical activity, and risk for CVD may provide insights into the adoption of heart healthy behaviors and CVD risk reduction in older women.

The statement of the problem for this thesis study includes an overview of the increasing burden of CVD, particularly in women. The need to change the focus from disease management to health promotion in the fight against CVD will be highlighted. The importance of promoting physical activity as a strategy to promote cardiovascular health in women, with a specific focus on the role of self-efficacy will be discussed. This chapter will conclude with a summary of the problem, the purpose of the study, research questions, and significance of the study.

### **Cardiovascular Disease**

Cardiovascular disease is a general term that is used to describe a number of conditions affecting the circulatory system including disorders of the blood vessels, heart rhythm problems, and congenital heart defects (Lewis et al., 2018). CVD is the number one cause of death worldwide, claiming more than 17.3 million lives each year (Mendis, Puska, & Norrving, 2011; Mozaffarian et al., 2016). In the United States, 610,000 people die each year of heart disease (CDC, 2017). Closer to home, CVD is responsible for 1/3 of all deaths in Canada; almost 100 people die every day as a result of this disease (Heart Research Institute [HRI], 2017).

Cardiovascular disease is a significant contributor to the burden of chronic disease in this country, affecting 2.4 million Canadians over the age of twenty (Government of Canada, 2017). Unfortunately, as our population continues to age the number of people affected by CVD and the

consequent burden of illness is predicted to rise (Roberts, Rao, Bennett, Loukine, & Jayaraman, 2015).

### **Burden of Cardiovascular Disease**

While the mortality rates are shocking, the morbidity rates are equally concerning. Cardiovascular disease is a progressive disease, which may result in damage to the heart muscle and a condition called heart failure. Of the million Canadians currently living with CVD, 600,000 have been diagnosed with heart failure and this number is predicted to rise as new technologies extend survival rates (HSF, 2016). Heart failure has a significant impact on a person's quality of life, causing debilitating symptoms, such shortness of breath, fatigue, weakness, and decreased exercise tolerance (HSF, 2016). In addition, heart failure is the third most common reason for hospitalization in Canada, contributing to the economic burden of this disease (HSF, 2016).

Overall, CVD costs the Canadian economy over 20 billion dollars each year (HRI, 2009). The majority of these expenditures are due to direct costs related to pharmaceuticals, physician visits, rehabilitation, and hospitalizations. However, there are also the indirect costs to consider, such as the loss of productivity incurred by those whose illness leaves them unable to work (Ball, Campbell, Burke, Pericleous, & Tarride, 2016). The burden on caregivers is also substantial, inflicting both mental and physical stress, and leading to poorer overall health (Haley, Roth, Howard, & Safford, 2010; Saito & Sadoshima, 2016). Thus, as the number of people with CVD continues to grow, strategies are desperately needed to protect both Canadians at risk and those they love against the damaging impact of this disease.

**Women and cardiovascular disease.** CVD is responsible for the deaths of 31,000 Canadian women each year (HSF, 2018). Although equal numbers of women and men are diagnosed with CVD, many gender-related disparities exist in the way the disease is recognized, diagnosed, and treated in women (Wenger, 2015). Once diagnosed with CVD women have poorer outcomes than men including: a higher 30-day mortality rate after a myocardial infarction (MI), increased risk of bleeding from anti-platelet therapy, and greater morbidity and mortality after coronary artery by-pass graft surgery (CABG; Mosca, Barrett-Connor, & Wenger, 2011). Women typically develop CVD 10 years later than men, so as the population continues to age women will make up a larger portion of those who are at risk for, and living with this disease (Mahmood et al., 2014; Mosca et al., 2011). Therefore, it is important to identify strategies that will reduce a women's risk for CVD and promote cardiovascular health.

### **Health Promotion**

Whereas disease prevention involves targeted, population-based interventions aimed at early detection of disease, with the goal of minimizing the burden of diseases and associated risk factors, health promotion is, “the process of empowering people to increase control over their health and its determinants through health literacy efforts and multisectoral action to increase healthy behaviors” (World Health Organization [WHO], 2017, para. 6). Health promotion strategies can be aimed at high risk populations or at the general community, to address behavioral risk factors such as smoking, obesity, diet, and sedentary behavior. This approach is well suited for use in helping a high risk group, such as women at risk for CVD, to develop healthy behavior through addressing CVD risk factors.

The promotion of health is a central tenet in the profession of nursing. According to the Canadian Nursing Association (CNS), “they (nurses) are adept at reinforcing health-promotion

strategies at interaction and transition points across the continuum of care which is key to achieving health empowerment and realizing the goal of health for all” (2015, pg. 3). Nurses are also opportunely situated to lead health promotion initiatives because they tend to have higher direct contact with patients and individuals at risk than any other healthcare provider (Cohn, Hyman, Rosenberg, & Larson, 2012). Therefore, it is important for nurses to assume a leadership role in promoting cardiovascular health in women at risk for CVD.

### **History of Cardiovascular Health Promotion**

While the medical community was developing medical and surgical treatment options for CVD, epidemiologists were studying this patient population to determine what could be causing the disease. The landmark Framingham Heart Study (Dawber, George, & Mann, 1957) examined the lifestyle habits of 5,000 adults who lived in the town of Framingham, Massachusetts. These researchers were the first to identify risk factors that were positively associated with an increased risk of heart disease: obesity, cigarette smoking, high blood pressure, and high cholesterol (Tsao & Vasan, 2015). It was also the first time that exercise was shown to directly reduce the risk of heart disease (Mahmood, Levy, Vasan, & Wang, 2014). These findings were the building blocks for a radically new approach to reducing the spread of CVD: disease prevention and health promotion.

In 1997, the AHA issued prevention guidelines to guide practitioners in their treatment of patients who are at high risk of developing CVD. However, to date, the primary prevention of CVD in the medical community has largely been focused on medically managing risk factors, such as hypercholesterolemia and hypertension, with little emphasis placed on lifestyle changes like physical activity (Grover, Coupal, Kaouache, & Lowensteyn, 2007; Miettinen et al., 1985). Research shows that physicians demonstrate low counselling rates for CVD preventative

behaviors, such as exercise and diet, despite having knowledge of professional guidelines (Tsui, Dodson, & Jacobson, 2004). Health promotion has emerged as an important strategy to reduce the threat of heart disease; in fact, national organizations such as the HSF and the AMA have recently shifted focus from preventing heart disease to the promotion of overall cardiovascular health (Hsu & Wong, 2017; HSF, 2017). The promotion of women's cardiovascular health must become a priority for all health care providers in order to improve the quality of life in this high risk population.

### **Heart Health Promotion in Women at Risk**

As CVD is primarily a lifestyle disease, risk awareness is a crucial component of health promotion among the female population. A major concern in the area of women's health is this group's lack of awareness that they are indeed at risk. A recent survey found that only 13% of women are aware that heart disease is their number one killer (Wenger, 2015). Fear of cancer remains the major concern in women, despite the fact that annual CVD mortality rates for women are double that of all forms of cancer combined (Ramachandran, Wu, Kowitlawakul, & Wang, 2016; Wenger, 2015). This lack of awareness is detrimental to cardiovascular health promoting behaviors in women.

Over the last 30 years, numerous efforts have been made to reduce the CVD burden through prevention strategies focused primarily on risk reduction through healthy lifestyle interventions, such as exercise, nutrition, and smoking cessation. In the 1970s, 1980s, and 1990s these efforts were focused predominantly on male populations (Burke, Dunbar-Jacon, & Hill, 1997). Fortunately, that trend has started to shift as evidenced by a recent scientific statement from the AHA (Artinian et al., 2010) reviewing interventions aimed at reducing CV risk in women. This report found that in the last decade, 57% of research on this topic in the United

States (US) has featured predominantly female samples. However, a closer examination of these studies revealed that the samples were primarily women under the age of 50 with a specific focus on high risk populations, such as low income women, and black women. While data on these subsets of women are important, women over fifty-five years of age are at greatest risk for CVD and should receive a specific focus in health promoting research.

### **Physical Activity and Heart Health Promotion**

In Canada, only 13% of adult women meet the recommended physical activity guidelines, compared to 17% of adult men (Statistics Canada, 2015). Unfortunately, this trend worsens with age as females between the ages of sixty and seventy-nine get the lowest amount of physical activity, reporting only eleven minutes of moderate physical activity per day (Statistics Canada, 2015). Declining levels of physical activity are closely correlated with rising obesity rates in women, another risk factor for CVD that is especially prevalent in women (Mosca, Barrett-Connor, & Wenger, 2011). In the Framingham Heart Study, obesity increased the risk of CVD by 64% in women, compared to only 46% in men (Wilson, D'Agostino, Sullivan, Parise, & Kannel, 2002). Obesity has a cascading effect on other risk factors and has been significantly associated with hypertension, hypocholesteremia, and diabetes mellitus (Poirier et al., 2006). These facts highlight the urgent need to better understand why women are not engaging in physical activity to control their risk for CVD.

Although preventative strategies have been somewhat successful in reducing CVD mortality rates through risk reduction, declining levels of physical activity and rising obesity rates contribute to a growing fear that this downward trend may be coming to an end and even possibly reversing (Jones, 2013; Mensah et al., 2017; Moran, Roth, Narula, & Mensah, 2014). Despite the strategies offered by preventative medicine to improve CVD risk through the

reduction of risk factors, 40% of adult Canadians report having three or more risk factors for CVD (Statistics Canada, 2017). Risk reduction is largely based on the avoidance of harmful behavior; however, as previously mentioned, there has been a recent shift in approach to focus on positive behaviors that make life enjoyable (Bittencourt, 2018). In physical activity research, this health promotion approach has been embraced through psychology-based interventions aimed at strengthening concepts like self-confidence and self-esteem in relation to this behavior (Bittencourt, 2018); consequently, self-efficacy has emerged as an important concept in understanding behavior related to physical activity in a variety of populations.

### **Self-Efficacy**

The AHA recommends strategies that incorporate self-efficacy enhancement to influence behavior change related to risk reduction (Artinian et al., 2010). Recent research has been shown to improve self-efficacy beliefs for exercise in samples of young working women (Barg et al., 2012; Buckley, 2016; Duncan, Rodgers, Hall, & Wilson, 2011; Joseph, Ainsworth, Mathis, Hooker, & Keller, 2017) and in middle-aged women with established CVD (Blanchard, Arthur, & Gunn, 2015; Dolansky, Stepanczuk, Charvat, & Moore, 2010; Sutton, Rolfe, Landry, Sternberg, & Price, 2012). However, little has been written about the exercise self-efficacy beliefs of healthy women over the age of 55 who are at highest risk of developing CVD. The proposed study will attempt to address this gap in the research.

### **Purpose of the Study**

The primary purpose of this study was to explore the association between women's self-efficacy, exercise self-efficacy, physical activity, and their CVD risk. The relationship between general self-efficacy and multidimensional exercise self-efficacy and the behavior of physical activity was also examined. Finally, interrelationships between self-efficacy beliefs and other

influencing factors, such outcome expectations, and demographic factors (i.e., age, BMI, physical activity) were examined.

### **Research Questions**

1. What is the relationship between actual CVD risk and self-efficacy in women at moderate to high risk for CVD?
2. What is the relationship between individual characteristics (i.e., age, BMI, living alone, post-secondary, education, frailty), past experiences (i.e., physical activity, physical fitness) and self-efficacy beliefs in women at moderate-high risk for CVD?
3. What is the relationship between self-efficacy for exercise and general self-efficacy in relation to the behavior of physical activity?
4. What is the relationship between self-efficacy and outcome expectations in women at risk for CVD?

### **Study Significance**

Women are at significant risk of developing CVD and yet many are not even aware that their health is threatened. Current health promotion strategies have largely been based on research carried out on male populations, despite the fact that CVD affects women in equal numbers as men. Nurses embrace a holistic approach to health and illness and they are optimally situated to lead health promotion initiatives; therefore, they are ideally suited to engaging and empowering underserved populations like women at risk of CVD to optimize their cardiovascular health. The goal of this research project was to gain knowledge about women's self-efficacy beliefs related to physical activity. The knowledge gained from this study will inform health practitioners caring for women at risk for CVD and guide in the development of interventions aimed at improving women's cardiovascular health.

### **Summary**

Women are at particular risk for developing CVD due to a large number of factors, including lack of risk awareness, lack of screening, and higher rates of certain risk factors, including low levels of physical activity. The last decade has taught us that women are unique in their CVD development and therefore interventions must be specifically tailored to meet their needs. Addressing decreased physical activity is particularly important because it has a cascading effect on the other CV risk factors, such as obesity, hypertension, diabetes, and hypocholesteremia. Self-efficacy has been found to be an important concept in understanding physical activity behaviors in male populations; however, little is known about the self-efficacy beliefs of women at risk for CVD. Therefore, this study aimed to gain an understanding of women's self-efficacy beliefs related to physical activity and to examine whether there is an association to their risk for CVD.

## **CHAPTER TWO: THEORETICAL FRAMEWORK**

A theory is a framework used to structure ideas and concepts in order to facilitate in the understanding of a phenomenon (Masters, 2015). “Theories are born from the need to solve a problem or explain a phenomenon that would account for a repeated occurrence” (Hayden, 2009, p. 2). In this thesis research project, the phenomenon in question was health behavior, specifically in the population of women at risk for CVD. Various theories have been developed in order to explain health behavior, including; the Social Cognitive Theory (SCT), the Health Belief Model (HBM), and the Health Promotion Model (HPM). A brief comparison of each of these models will establish the most appropriate framework for this thesis project.

### **The Social Cognitive Theory**

Alfred Bandura, an American social psychologist, first published his SCT in 1986. Bandura was a pioneer in his approach to human behavior, arguing that individuals are self-reflective and self-regulating (Bandura, 1986). He further explained that human behavior is largely learned through social interactions and based on cognitive thinking, not just as a reaction to external forces; furthermore, humans interact with their environment and can even shape their environment through their actions. A major concept in the SCT is self-efficacy, defined as “the belief in one's capabilities to organize and execute the sources of action required to produce given attainments” (Bandura, 1997, p. 3). According to Bandura, self-efficacy beliefs largely determine an individual’s adoption and persistence of a behavior. Strong self-efficacy beliefs indicate that individuals are confident that they have the skills required to perform a task; conversely, weak self-efficacy beliefs are seen in individuals who do not believe that they have the required ability to perform a given behavior.

Bandura (1997) identifies four sources of self-efficacy (see Figure 1): mastery experiences, vicarious experiences, verbal persuasion, and physiological feedback. Mastery experiences involve performing a task successfully, such as walking around the track or choosing a healthy snack. This source of self-efficacy, which adds to a sense of confidence in one's abilities, is thought to have the most impact on behavior change (Bandura, 1997). Vicarious experience entails an individual observing the successful completion of a task by someone considered to be similar to themselves; for example, observing fellow cardiac rehabilitation (CR) participants gain exercise tolerance. The third source of self-efficacy is verbal persuasion, which occurs when individuals are told that they are capable of successfully completing the desired task; for example, when a nurse encourages patients in their efforts to exercise. Lastly, physiological feedback includes the individual's ability to control physical and emotional reactions to a behavior; for example, when a patient with cardiac disease is able to control the fear of experiencing chest pain with increased activity.

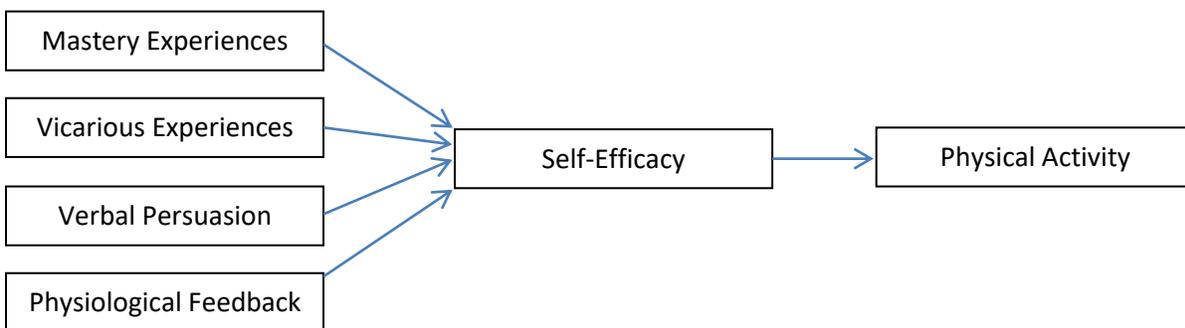


Figure 1 : The Self-Efficacy Model: Public domain material as adapted from:

[http://www.science.smith.edu/exer\\_sci/ESS570/SE/Bandura\\_SE.html](http://www.science.smith.edu/exer_sci/ESS570/SE/Bandura_SE.html)

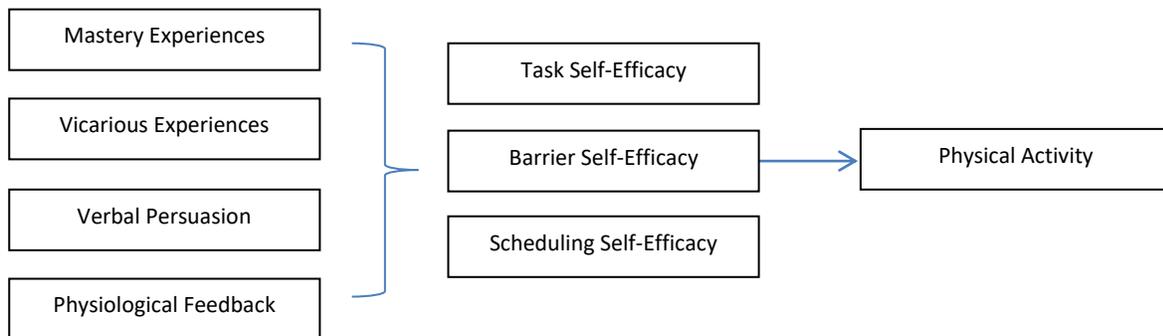
Individuals with a strong sense of self-efficacy set challenging goals and are strongly committed to achieving them (Masters, 2015). When challenges arise, those with confidence in their abilities will increase their efforts in order to succeed (Bandura, 1997). Conversely, those who doubt their abilities will feel threatened by difficult tasks and if obstacles persist they will lose faith in their own capabilities. In addition, when self-efficacy beliefs are strong there is a reduction in stress and depression (Bandura, 1997).

Self-efficacy has been found to be one of the clearest correlates of physical activity. Some researchers have proposed adaptations to Bandura's theory in order to gain a better understanding of this specific behavior. One such adaptation proposes that exercise behavior is complex and may require multiple types of self-efficacy in order to be successful (Rodgers, Murray, Wilson, Hall, & Fraser, 2008). Based on Bandura's (1997) contention that SE may be "multifaceted," Rodgers et al., (2008) developed a Multidimensional Self-Efficacy for Exercise Scale (MSES) to predict behavior in an adult population. This scale includes three types of self-efficacy: task self-efficacy, barrier self-efficacy, and scheduling self-efficacy which together predict the behavior of physical activity (see Figure 2). This unique approach to predicting self-efficacy for exercise behaviors were used in this thesis study.

### **Disease Prevention versus Health Promotion**

Disease prevention strategies are targeted, population-based interventions aimed at early detection of disease, with the goal of minimize the burden of diseases and associated risk factors (WHO, 2017). Three levels of prevention strategies are used to prevent chronic illnesses, such as CVD: primary, secondary, and tertiary prevention. Primary prevention refers to interventions used to prevent the disease before it occurs. Primary prevention programs are often aimed at a population, such as the national ParticipACTION exercise campaign. Secondary prevention

strategies attempt to detect and treat diseases early in their course. In CVD, the angiogram is used as a secondary prevention measure to identify people with narrowed coronary arteries so that treatments can be initiated early in the disease trajectory before reduced blood flow can result in permanent damage to the heart muscle. Tertiary prevention focuses those who are living with the disease and aims at slowing disease progression and maximizing quality of life. Cardiac rehabilitation is an example of a tertiary prevention strategy and it aims to help those with CVD to manage their disease.



*Figure 2: Multidimensional Self-Efficacy for Physical Activity Behavior as adapted from [http://www.science.smith.edu/exer\\_sci/ESS570/SE/Bandura\\_SE.html](http://www.science.smith.edu/exer_sci/ESS570/SE/Bandura_SE.html)*

Alternatively, health promotion aims to empower individuals to take control of their health through interventions that promote quality of life (WHO, 2017). Health promotion strategies can be aimed at high risk populations or at the general community, to address behavioral risk factors like smoking, obesity, diet, and sedentary behavior. This approach is well suited for use in helping a high risk group, such as women at risk for CVD, to develop healthy behavior through addressing CVD risk factors.

### The Health Belief Model

The HBM (see Figure 3) is one of the most widely used theories of health behavior; it has been applied extensively in a variety of health care contexts. The purpose of the HBM is to provide a theoretical framework for understanding how an individual's perceptions of a health threat, combined with their beliefs about the utility of a possible preventative act, can predict the likelihood of taking that specific action (Simons-Morton, 2012). Generally, the HBM contends that in order predict whether individuals will engage in a preventative health action they must consider themselves to be susceptible to a condition, believe that the condition will have potentially serious consequences, and think that a course of action is available to them that will reduce their susceptibility. Additionally, individuals must be convinced that the anticipated benefits of taking the proposed action outweigh the barriers (Becker, 1974). Consequently, this model may be useful in studying why women at risk for heart disease approach or avoid the risk reducing health behavior of increased physical activity. An overview of the HBM will summarize the major concepts of the model and provide insight into the appropriateness of this framework in guiding this thesis study.

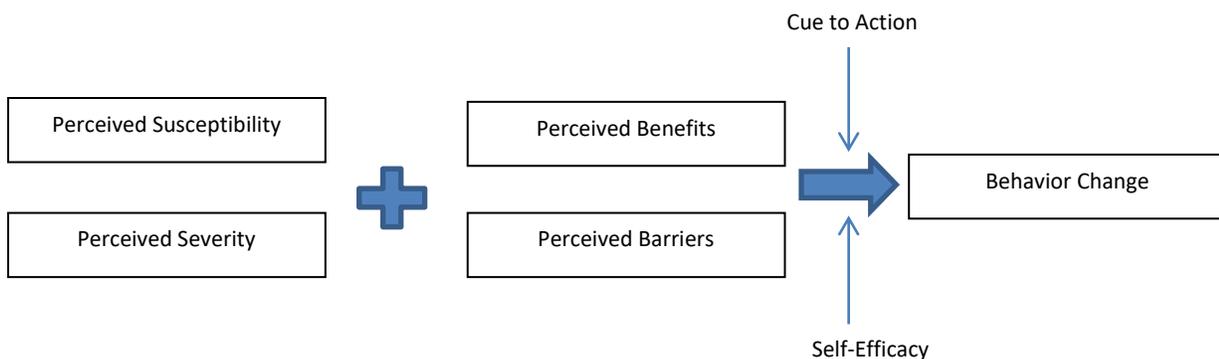


Figure 3 : The Health Belief Model: Public domain material as adapted from [www.google.ca/image](http://www.google.ca/image), 2011

## Background

The HBM was developed in the 1960s by psychologists working in the American public health system. They were attempting to understand why some healthy individuals would not participate in health screening programs despite the fact that these programs were easily accessible, free of charge, and improved health outcomes. These theorists were social psychologists and consequently their theory was strongly influenced by the work of Kurt Lewin (Becker, 1974). Lewin's (1938) classic value expectancy theory argues that individuals make choices based on the value that they place on an expected outcome. Therefore, the HBM sought to understand how perception of a health risk was related to disease prevention behavior (Hayden, 2009).

The HBM was one of the first theories developed to understand disease prevention behavior. Over time, the model has been used to study increasingly complex behaviors. Initially the model was applied to screening behavior for a variety of illness including tuberculosis, cervical cancer, and dental disease, but it has been expanded to include behavior related to immunizations and compliance with a variety of medical treatment conditions such as diabetes, renal failure, and hypertension (Becker, 1974; Harrison, Mullen, & Green, 1992; Janz & Becker, 1984). As a natural consequence of its continued use, the HBM has been gradually modified, with determinants added in order to clarify behavior. In the 1960s the variable of *cues to action* was added to describe various sources of stimuli that may trigger one's readiness to act (Becker, 1974). In 1988, Rosenstock and colleagues further expanded the theory to include the SCT concept of self-efficacy. Rosenstock et al., (1988) explained that the theory was initially based on the performance of a simple, passive behavior (i.e., receiving a vaccination), which did not require a significant amount of confidence to perform. As the model's use was expanded to

include more complex behaviors (i.e. physical activity), confidence to perform these actions became recognized as an important consideration in the decision-making process.

### **Components of the Health Belief Model**

The underlying premise of the HBM is that health behavior is determined by personal perceptions about a disease and available strategies (i.e., health behaviors) to prevent its occurrence. These personal perceptions are influenced by many factors, which together inform an individual's decision to engage in or avoid a considered health behavior. Four main constructs make up the model: perceived susceptibility, perceived seriousness, perceived benefits, and perceived barriers (Becker, 1974). Each of these perceptions alone or in combination can predict health behavior. These constructs are modified by other variables including personal factors, cues to action, and self-efficacy beliefs. A brief overview of each construct, as well as the modifying variables will be provided, followed by the strength and weaknesses of this theory.

*Perceived susceptibility* describes an individual's perception of his/her chances of contracting a disease (Becker, 1974). The level of risk felt by an individual varies widely from having no fear of becoming ill to being seriously concerned about this occurrence. *Perceived seriousness* is an individual's perception of the seriousness of a disease and is based on the potential impact that this illness may have on their lives (Becker, 1974). These feelings are often based on medical information or knowledge, but can also be formed by the personal beliefs that individuals hold about the negative effect this disease may have on their lives (Hayden, 2009). Together, an individual's sense of perceived susceptibility and perceived seriousness combine to influence their perceived threat of illness (Stretcher & Rosenstock, 1997). The HBM theory predicts that when individuals feel threatened by a disease they are more likely to change their behavior in order to avoid this potential threat.

The construct of *perceived benefits* involves personal opinion about the value that a new behavior may have in decreasing the risk of developing the disease (Becker, 1974). For this to be true there must be at least one available action that is subjectively possible. Since changing behavior is a difficult process, the fourth construct in the HBM is *perceived barriers* to change that an individual assesses when considering a new behavior. This is an individual's own evaluation of all of the obstacles in the way of achieving the proposed behavior (Hayden, 2009). Of the four major constructs in this theory, perceived barriers have been shown to be the most significant in determining whether behavior will change (Carpenter, 2010). An individual will make the decision to adopt new health behavior only if the perceived benefits of taking this action will outweigh the perceived barriers that stand in the way.

*Cues to Action* are sources of outside information that may urge a person towards a health behavior. These cues are events, people, or things that can move an individual towards action. Examples of cues are mass media campaigns, advice from others, reminder postcards from a physician or dentist, illness of a family member or friend, or newspaper or magazine articles (Hayden, 2009). Rosenstock (1974) explains that although levels of susceptibility and severity provide a force to action and benefits may offer direction, these influences need an "instigating event to set the process in motion" (p. 5).

*Self-efficacy*, the last explanatory variable in the HBM, the belief in one's own ability to perform a behavior (Bandura, 1997). In general, people do not attempt a behavior unless they think that they can do it. Conversely, behaviors are often avoided if an individual believes that failure is the most likely outcome. As mentioned previously, this variable was added to the model in 1988. Subsequent use of the revised model has strongly supported the inclusion of this

variable in predicting health behavior (Abdolaliyan, Shahnazi, Kzemi, & Hasanzadeh, 2017; Srof & Velsor-Friedrich, 2006; Vanden Bosch, Robbins, & Anderson, 2015).

### **Strengths and Limitations of the Health Belief Model**

The HBM has been used as a guiding framework in a variety of health-related research, including the health behavior of physical activity. In the majority of studies that used the HBM to frame research on physical activity, self-efficacy emerged as the strongest correlate of this type of behavior (Abdolaliyan et al., 2017; Gammage & Klentrou, 2011; Jumper, Oman, Hamm, & Kerby, 2004; Mo, Chong, Mak, Wong, & Lau, 2016). However, the HBM has been criticized for having poorly defined concepts and for failing to describe the relationship between individual variables and behaviors (Carpenter, 2010; Glanz, Rimer, & Lewis, 2008; Munro, Lewin, Swart, & Volmink, 2007). A meta-analysis of the HBM supports this criticism, identifying that of the 18 studies reviewed, results were varied and often conflicting in their findings (Carpenter, 2010).

In the context of the current proposed study, the key limitation to the HBM was its incompatibility with a holistic health perspective, as embraced by the nursing profession. Nurses define health as a holistic experience that “goes beyond disease prevention and risk reduction” (Pender, 2015, p.15). The HBM takes a limited view of health, defining wellness as the absence of illness, which is not consistent with the holistic approach taken by the profession of nursing. Another reason why the HBM was not chosen for this thesis project was due to the use of fear as a motivating factor in health behavior decision making. This approach is also contrary to the care-based focus of nursing. As part of the Lewinian influence of this model, behavior is only considered in the present moment with little thought given to past experiences. This is also contrary to the nursing approach, which views past experiences as informing the present

(McEwen, 2011). Therefore, the HBM, with its primary focus on disease prevention, was not an ideal framework for this thesis study.

### Health Promotion Model

The HPM (see Figure 4) was created to explain the complex, multi-dimensional nature of people interacting with their environment in the pursuit of health (Masters, 2015). The model was developed to guide nurses in understanding the major determinants of health behavior so that this knowledge can guide in the promotion of health. The major constructs of the model, as well as its strengths and limitations, will be discussed. Only selected variables of the model are applicable to the proposed research project (see Figure 5); however, a brief description of each variable will be included to facilitate an understanding of the model as a whole.

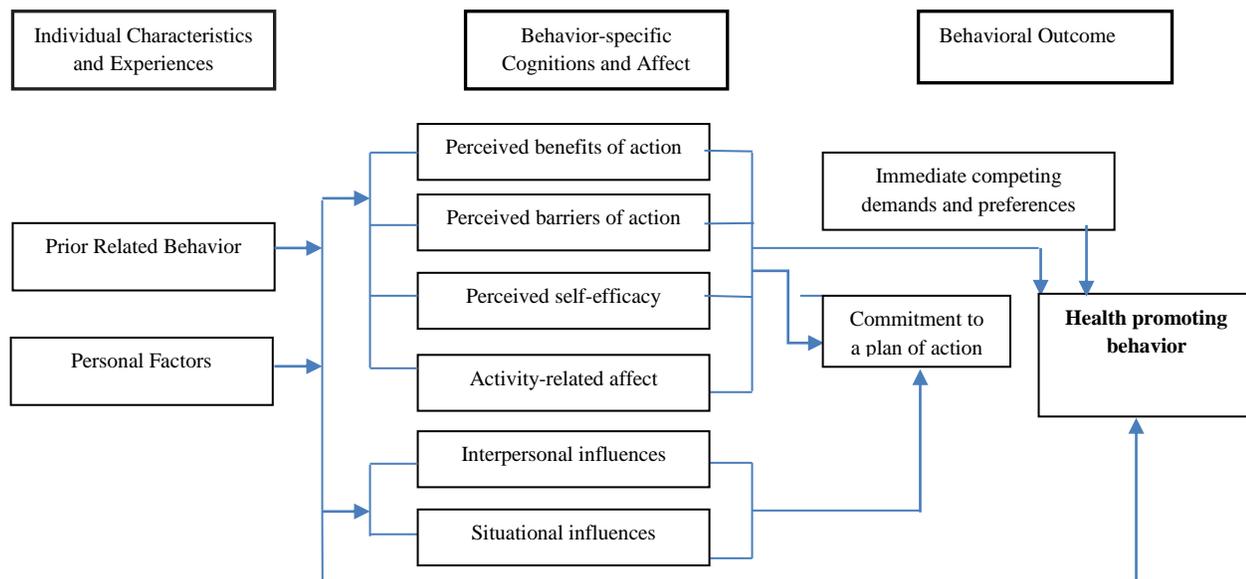
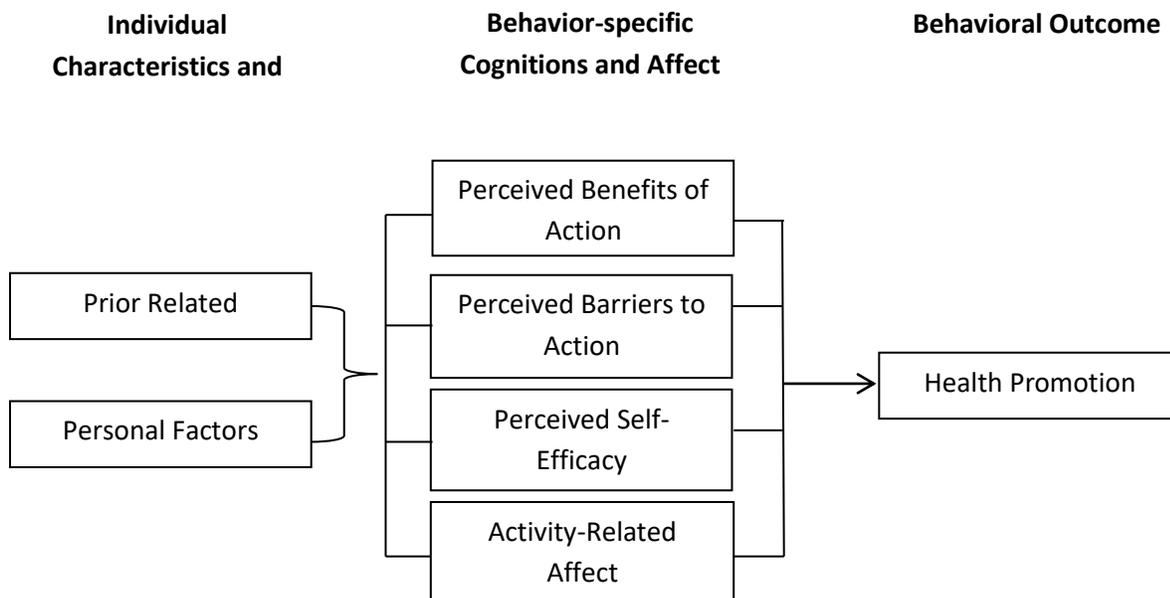


Figure 4: The Health Promotion Model: Public domain material as retrieved from <http://nursingtheories.weebly.com/nola-pender.html>

### Background

Nola Pender published the original HPM in the 1980s, as a framework based on a nursing perspective of factors that influence health behaviors. She proposed a broad definition of health:

“the actualization of human potential through integrated functioning of individuals and groups in interaction with their environment” (Pender, 2015, p. 21). Pender proposed that health was more than a move away from the negativity of illness, but rather a positive dynamic state all on its own. The HPM was designed to complement existing health protection models such as the HBM and was based on two social psychology theories, the expectancy value theory and the SCT. The expectancy value theory claims that individuals engage in actions to achieve goals, which they deem possible and that are valued (Fishbein, 1975). The SCT argues that thought, behavior, and environment all interact with each other and that to change behavior an individual must change how they think (Bandura, 1986).



*Figure 5:* A modified diagram highlighting the integral components and relationships in the Health Promotion Model. Adapted from <http://nursingtheories.weebly.com/nola-pender.html>

### **Components of the Health Promotion Model**

The HPM is divided into three sections: individual characteristics, behavior-specific cognitions and affect, and behavioral outcomes. Pender postulates that health-seeking behavior is

due to the influence of an individual's unique characteristics and experiences, as well as their behavior-specific thoughts and feelings (Thomas, Hart, & Burman, 2014).

### **Individual Characteristics and Experiences**

In the HPM, individual characteristics and experiences are thought to have an indirect influence on a person's thoughts and feelings toward a specific health behavior. These characteristics are comprised of personal elements, such as biological, psychological, and sociocultural factors. Biological characteristics include factors such as age, body mass index, and sex. Psychological traits include self-esteem, self-motivation, and perceived health status. Finally, sociocultural factors may encompass race, ethnicity, acculturation, education, and socioeconomic status. It is important to note that Pender cautions that only personal factors that are theoretically relevant to explain predicted behavior should be included when applying the model.

An individual's past behavior is often the best predictor of whether they will engage in that behavior in the future. Pender (2015) explains that prior behavior has both direct and indirect effects on the likelihood of future engagement in the health behavior. The direct effect of past behavior on present health promoting behavior is the formation of habit, which comes through repeating an action until it becomes automatic. The indirect effect of past behavior is the influence on cognitive perceptions of the behavior, such as self-efficacy, benefits, barriers, and activity related affect. When considering a potential behavior, individuals will remember their past experiences and consider their success in completing the behavior, the positive outcomes of participation, the obstacles that were faced and the way the entire experience made them feel. The totalities of these experiences will have an indirect impact on whether the behavior is attempted.

### **Behavior-Specific Cognitions and Affect**

The largest component of the HBM is based on behavior-specific cognitions and affect. This section examines the perceived thoughts and feelings that people experience related to a potential health behavior including their perception of benefits, barriers, and self-efficacy beliefs, as well as their activity-related affect.

*Perceived benefits of action* are the positive outcomes that an individual foresees will result from engaging in the considered behavior (Pender, 2015). These outcomes provide direct and indirect motivation for the individual and influence the amount of effort they will expend on achieving the proposed benefit. Positive experiences reinforce the potential benefit of the behavior and may serve to motivate the individual's future participation (Pender, 2015). When considering the behavior of physical activity, the intrinsic benefits may include: enjoyment of an activity, increased alertness or energy, or increase in perceived attractiveness. This concept is similar to the outcome expectations described by Bandura (1986) in his SCT.

*Perceived barriers* are an individual's perceptions about the difficulties associated with attempting this type of behavior such as: inconvenience, expense, difficulty, or time-consuming (Pender, 2015). When barriers are considered high, the proposed behavior is usually avoided. These challenges, which stand in the way of health behavior, may be anticipated, real, or imagined (Masters, 2015). For example, when considering physical activity an individual may add up the time required to travel to the gym and engage in an exercise class or choose not to participate due to their perception of a time-consuming obstacle.

*Perceived self-efficacy* is the judgement of personal capability to successfully carry out a specific action (Masters, 2015). Self-efficacy is an individual's judgment of what they are able to do with the skills they possess. Those who feel confident in their abilities are more likely engage

in this behavior repeatedly and gain skill and proficiency (Pender, 2015). Conversely, individuals who lack self-efficacy will avoid performing a health behavior if they perceive that they do not have adequate skill to succeed. For example, if a woman has never entered a gym, she may have low self-efficacy for exercise and doubt her ability to successfully participate in an exercise class.

*Activity related affect* refers to the positive or negative feelings an individual experiences before, during, and after a behavior (Masters, 2015). In keeping with the SCT, these feelings are thought to influence an individual's sense of self-efficacy, (Bandura, 1986). When positive emotions are associated with a behavior, this contributes to a stronger sense of confidence in one's abilities. Conversely, when negative emotions are elicited, this can detract from self-efficacy for that particular behavior. For instance, if an individual has a heart attack while riding their bike they may experience feelings of fear and anxiety when they contemplate this behavior in the future. This construct mirrors Bandura's (1986) description of psychological feedback in the SCT.

*Interpersonal and situation influences* are cognitions that are thought to affect the decision to engage in a health behavior. Interpersonal influences are thoughts, real or imagined, about the behaviors, beliefs, and attitudes of others (Pender, 2015). Primary sources of interpersonal influence on health behavior include family, peers, and health care providers. Situational influences are perceptions of any situation, including available options, demand characteristics, and aesthetic features of the environment (Masters, 2015). This construct is similar to the vicarious experiences described by Bandura in the SCT (1986).

*Commitment to a plan of action* is what initiates a behavioral event. Commitment pushes the individual into action unless there is a competing demand that takes priority (Pender, 2015).

In the HPM, commitment to a plan of action must include specific details about when and where the behavior will be carried out, and a detailed strategy about how this will happen. *Competing demands* are alternative behaviors over which the individual has relatively little control (Pender, 2015). Alternatively, *competing preferences* are behaviors over which the individual may have a significant amount of control, depending on their ability to self-regulate (Pender, 2015). In the HPM, competing demands and preferences directly influence the occurrence of a health behavior and indirectly influence the level of commitment.

*Health promoting behavior* is the end point in the HPM. The goal of this behavior is “improved health, enhanced functional ability, and better quality of life at all stages of development” (Pender, 2015, p. 40). In the context of this thesis study, the model was used to study a women’s decision-making process regarding the behavioral outcome of physical activity. It is important to gain a deeper understanding of why women choose to engage in physical activity or to avoid this behavior, because this decision will greatly impact their risk for CVD.

### **Strengths and Limitations of the Health Promotion Model**

The HPM has been used extensively in nursing research to explain and predict specific health behaviors (da Silva Santos et al., 2018; de Araújo Gama, Soares Figueiredo Trezza, da Silva Rodrigues, & de Melo Cezar Alves, 2016; Ersin & Bahar, 2017; Khodaveisi, Omid, Farokhi, & Soltanian, 2017). The strength of this model is the holistic approach that is taken toward the concepts of health, the individual, and behavior. The model uses a competence-oriented, positive approach to behavior change instead of the fear-based approach, which is used in the HBM. As Pender (2015) points out, “although immediate threats to health have been shown to motivate action, threats in the distant future lack the same motivational strength”

(2015, p. 34). This idea is important when promoting behavior change in women who are currently healthy and are interested in improving their cardiovascular health.

The HPM considers the individual's past experiences as an important source of influence on current health decisions. Pender integrates Bandura's SCT by acknowledging the effect of past behavioral experiences on current self-efficacy beliefs, outcome expectations, and activity-related affects. Nurses place significant value on past behavior as they view individuals within the entirety of their experiences (McEwen, 2011). For example, important information on current behavior may be gleaned from a woman's experiences with physical activity in childhood, adolescence, and early adulthood.

The HPM also considers external factors that may influence an individual's decision to engage in healthy behavior. Interpersonal influences describe the behaviors and beliefs of others and acknowledge that health decisions are not made in isolation, but in families, social group, and communities. Furthermore, situational influences are thought to represent the determinants of health, including the lack of available options and environmental concerns. This concept is central to nursing and describes how health is more than a result of personal choices, it is also a consequence of our environment.

Finally, the concept of self-efficacy is a central concept in the HPM. Pender has included the major components of Bandura's theory into her model, which allows this concept to be operationalized with accuracy. The four sources of self-efficacy can be found in the model: prior behavior provides information about mastery experiences, verbal persuasion and vicarious experiences are seen in interpersonal influences, and activity related affect represents the source of physiological feedback. Additionally, Bandura's concept of outcome expectations is described

in the perceived benefits of health. As this concept was central to this thesis study, the HPM framework was an appropriate choice for guiding this discussion.

A major limitation of the HPM is the size of the model, as it encompasses three major concepts and ten sub-concepts that together describe the complex interaction between individuals who are contemplating health behaviors and their environment. Due to this limitation, most researchers use only part of the model and, subsequently the model is rarely tested in its entirety. Another limitation of the HPM is the assumption that individuals actively seek to regulate their own health and that they value growth in this area (Masters, 2015). These limitations must be considered before choosing to use this model.

### **Summary**

The HPM is well suited for an exploration of the health behaviors of women who are at risk for CVD. This framework provides a nursing perspective on the determinants of health behaviors with a strong integration of the concept of self-efficacy. The model defines health in holistic terms and focuses on empowerment as a motivator for behavior change rather than fear. While other models offer strengths in guiding health behavior research, the HPM was the best fit for guiding this thesis project on women's self-efficacy beliefs related to physical activity.

### **Definition of Terms**

The following terms are not commonly used in the profession of nursing and have therefore been defined to ensure clarity of topics discussed in this thesis project.

**Exercise** is a subset of physical activity which includes planned, structure and repetitive body movement, with the goal of improving or maintaining physical fitness (WHO, 2018).

**Frailty** is characterized by a loss of physiological reserve and loss of homeostatic capabilities leading to a vulnerability to adverse health events (Fried, 2001)

**Outcome Expectations** are the beliefs about the likelihood of a behavior leading to a specific outcome (Bandura, 1997, p.22).

**Physical Activity** is any bodily movement produced by skeletal muscles that result in energy expenditure above resting metabolic rate (WHO, 2018).

**Physical Fitness** is the ability to carry out tasks without undue fatigue (Caspersen, Powell, Christiansen, 1985).

**Self-Efficacy** is one's belief in one's ability to succeed in specific situations or accomplish a task (Bandura, 1997, p.3).

### **CHAPTER THREE: REVIEW OF THE LITERATURE**

The purpose of this chapter is to examine the existing literature related to the key study concepts of women, cardiovascular disease (CVD) risk, self-efficacy, and physical. An understanding of these concepts will establish a background for the study by uncovering what is known about the subject. This review will also focus on the current context for this study and provide rationale for why this research was necessary. The HPM will be used as a framework to organize and guide this literature review.

#### **Background**

As the burden of illness in Canada has gradually shifted to diseases that are chronic in nature, health research has attempted to understand these conditions and their causes. Starting in the 1950s, large-scale studies were conducted to try and link specific behavior to the development of chronic disease; these studies included the Framingham Heart Study (Dawber, Meaders, & Moore, 1951), the British Doctors Study (Doll & Hill, 1956), and the Seven Countries Study (Keys et al., 1966). From this work, the risk factors of cigarette smoking, physical inactivity, and high blood pressure were positively identified as causative factors in the development of CVD. This early insight into behaviors that contribute to chronic disease was the precursor to the future field of health promotion.

Over the next decade, researchers moved from collecting data about chronic illness to testing interventions aimed at reducing or preventing this form of disease. Interventions focused on reducing an individual's risk factors through: smoking cessation (Flay, Gruder, Warnecke, Jason, & Peterson, 1989; Lowe, Windsor, & Post, 1987; Rose & Hamilton, 1978; Rose, Hamilton, Colwell, & Shipley, 1982), blood pressure reduction (Ewart et al., 1987; Staessen et al., 1988), cholesterol management (Bruno, Arnold, Jacobson, Winick, & Wynder, 1983;

Ostwald, 1989), and exercise adoption (Blair et al., 1985; Nader et al., 1983; Ventura et al., 1984). The majority of these studies were carried out on groups of people in public settings, such as workplaces and public schools; consequently, the populations under study were primarily adult males and school-age children, occasionally including their families.

As a result of the 1986 Ottawa Charter, health researchers began to explore a new and positive definition of health, which was no longer centered on the absence of illness, but rather on an overall state of well-being (WHO, 2018). The Charter called for participation and empowerment, employing various strategies to achieve these goals including, “the development of personal skills” (WHO, 2018, para. 9). To this end, health promotion research in the 1990s explored the impact of delivering risk reduction education to groups of individuals at varying levels of risk for CVD (Arbeit et al., 1992; Baer, 1993; Cupples & McKnight, 1994; Roderick, Brennan, & Meade, 1995). As this field began to evolve, the emerging complexity of behavior prompted researchers to develop increasingly complex interventions. Personal skill development was attempted through interventions aimed at cognitive strategies, such as behavior counselling (Gomel, Oldenburg, Simpson, & Owen, 1993), development of coping skills (Killen et al., 1993), goal setting (Mayer et al., 1994), and building self-esteem (Stewart et al., 1997).

In the twenty-first century, a growing body of research continues to explore the increasingly complex problem of behavior modification related to the development of CVD, using a variety of strategies aimed at various segments of the population. With firmly established cardiovascular risk factors, the challenge continues to center around understanding how to assist individuals to adopt health behaviors in order to reduce their risk of CVD. Various aspects of CVD risk reduction have been addressed, including interventions focused on general populations versus those at higher risk (Emberson, Whincup, Morris, Walker, & Ebrahim, 2004; Maron et

al., 2008). The risk reduction message has been delivered using diverse communication styles including positive emotional expression (Tuck, Adams, Pressman, & Consedine, 2017), and motivational counselling techniques (Hayashi, Farrell, Chaput, Rocha, & Hernandez, 2010; Perry, Rosenfeld, Bennett, & Potempa, 2007; Rejeski et al., 2003). Tailored interventions focusing on the adoption of healthy behaviors, such as exercise, healthy diet, and smoking cessation, have been used in an attempt to reduce CVD risk (Delecluse et al., 2004; Furukawa et al., 2003; Gusi, Reyes, Gonzalez-Guerrero, Herrera, & Garcia, 2008; Hayashi et al., 2010). Additionally, multiple change theories have been used to guide the process of teaching new health behavior in order to reduce the risk of CVD (Emmen et al., 2006; Hayashi et al., 2010; Jacobs et al., 2004; Woollard, Burke, Beilin, Verheijden, & Bulsara, 2003).

In 1992, the National Heart, Lung, and Blood Institute Conference on Cardiovascular Health and Disease held a conference focusing on “Cardiovascular Health and Disease in Women,” and concluded that “we have insufficient information about the preventative strategies, diagnostic testing, responses to medical and surgical therapies and other aspect of cardiovascular illness in women” (Wenger, Speroff, & Packard, 1993, p.247). In 2001, the Institute of Medicine (Wizemann & Pardue) identified that sex and gender matter in the treatment of CVD; this contention was further supported when the results of two large trials, the Heart and Estrogen/progestin Study (HERS; Hulley et al, 1998) and the Women’s Health Initiative (WHI; Rossouw, Anderson, Prentice, & LaCroix, 2002) were published and refuted the role of hormone replacement therapy (HRT) in the prevention of CVD. In 2003, a systematic review of relevant research on the topic of women and CVD concluded that contemporary recommendations on the prevention and treatment of this disease in women were largely based on studies conducted on

middle-aged men and therefore more sex specific research was needed (Grady, Chaput, Kristoff, 2003).

Although some health promotion strategies have been successful in the reduction of CVD, certain populations remain at higher risk and therefore deserve specific attention when addressing risk modification. Women are at particular risk of developing CVD; therefore, the following literature review will focus on the health promotion research in this population. The HPM will be used as a framework to organize and present the results of this literature review.

### **Review of the Literature**

The HPM provides a framework through which to understand how individuals approach health behavior. The engagement in these types of activities can have a positive effect in the management of risk factors, which in turn can lead to a reduction in chronic diseases, such as CVD. Therefore, the health promotion literature on the topic of CVD risk will be explored according to the concepts that make up the HPM. This approach will be useful in organizing this body of literature, with the goal to identify gaps in research on women at risk for CVD.

### **Individual Characteristics and Experiences**

According to the HPM, individual characteristics and personal experiences are important factors in predicting future behavior (Pender, 2015). Relevant to this thesis study, individual characteristics can include sex, age, and physical characteristics, such as body mass index (BMI), and frailty. These personal factors have all been found to have an influence on an individual's health status and the ability to engage in healthy activities. Additionally, research has shown that previous behavior is the best indicator of whether an individual will engage in a similar behavior in the future (Pender, 2015); therefore, it is important to understand how an individual's past

experiences influence the behavior of physical activity. The unique characteristics and behaviors of women, within the context of CV health promotion, will be the focus of this review.

### **Personal Factors**

**Sex.** Recent research is beginning to show that there are sex differences in the way that men and women experience CVD. These differences occur in many facets of the disease, including the factors that put women at risk for CVD. In a scientific statement by the AHA, Mehta and colleagues (2016) noted that some of the traditional risk factors are more profound in women than men. For example, Yusef et al. (2004) performed an international, case control study of adults with CVD (N=29,972) in 52 countries and reported that hypertension was more strongly associated with MI in women compared with men. Although elevated cholesterol presents a risk for CVD in both men and women, certain types of cholesterol have been found to be more predictive of CVD in female populations (Cífková, & Krajčoviechová, 2015). This finding was supported in the Nurses' Health Study (Shai et al., 2004), where baseline lipid profiles of postmenopausal women (N=32,836) were correlated with future cardiac events, and low HDL and hypertriglyceridemia were found to be more significant predictors of CVD in women. Similarly, Wilson et al. (2002) examined data from the Framingham Heart Study, which featured adults between the age of 35-75 years (N=5209) and found that obesity increased the relative risk of CVD in women by 64% compared to 46% in men. Many of these risk factors develop due to behavior that is learned early in life; therefore, it is important to establish CV health promotion programming at an early age for women, in particular.

Young women have also been found to face unique risk factors due to a number of sex specific reasons. Complications related to pregnancy, including preterm delivery, pre-eclampsia, and gestational diabetes are all risk factors for the development of CVD (Garcia, Mulvagh, Merz,

Buring, & Manson, 2016). For example, Kessous, Shoham-Vardi, Pariente, Holeberg, and Sheiner (2013) studied a cohort of women (N=47,908) and found that after 10 years of follow up the women who delivered preterm (N=5,992) had a higher incidence of cardiac events than those women who delivered at term. Similarly, Bellamy, Casa, Hingorani, and Williams (2007) performed a meta-analysis with 198,252 pre-eclamptic women and found that compared to women with normotensive pregnancies, the former group had a 3.7-fold increase in their relative risk for developing hypertension in the fourteen years after pregnancy. Young women are also more prone to spontaneous coronary artery dissection (SCAD). SCAD is more common in women than men and it is the leading cause of MIs in women under the age of 50 (Wagers, Stevens, Ross, Leon, Masters, 2018).

Other risk factors that, are unique to women, include complications from sex-specific cancer treatments and psychological symptoms like anxiety and depression. Darby et al. (2013) compared Danish and Swedish women (N=2,168) who underwent radiotherapy for breast cancer and found that this exposure increased the risk of developing CVD over the next twenty years. A diagnosis of depression has been found to be a powerful risk factor for CVD, with the younger female population being most significantly affected (Garcia et al., 2016; Huffman, Celano, Beach, Motiwala, & Januzzi, 2013). Nabi and colleagues (2010) measured baseline psychological symptoms in a sample of male and female adults (N=24,128) and monitored them for CVD events over the subsequent seven years. The results of this study showed that women with symptoms of anxiety were at greater risk of developing CVD. Similarly, Wyman, Crum, and Celentano (2012) examined data from a national health survey of men and women aged 17-39 and found that depression was an independent predictor in the development of premature CVD; 50% of deaths among females aged 18-39 with depressed mood were related to cardiac

events compared to 13% of deaths in women of similar age without depression. Although few women develop CVD at a young age, the early identification of risk factors in this population may reduce future development of disease through early CV health promotion.

Women are often unaware of their risk for CVD. Mosca, Hammond, Mochari-Greenberger, Towfighi, and Albert (2013) analyzed national survey data on women's perception of CVD risk (N=2,432) and compared these responses to similar surveys from 1997, 2000, 2003, 2006, and 2009. They found that although women's awareness of CVD risk had doubled over the previous fifteen years it remained suboptimal, with younger women (aged 25-34) reporting the lowest level of risk awareness (Mosca et al., 2013). Further research has highlighted additional concerns for young women's CV health; Galbraith, Mehta, Veledar, Vaccarino, and Wenger (2011) analyzed results from a national survey exploring women's knowledge of CVD prevention (N=534) and found that age was the strongest predictor of motivation to modify CVD risk factors. Research has also demonstrated that women may not apply general CVD risk awareness to themselves. Kling et al. (2013) surveyed women (N=294) who attended CV health events and found that "although they are aware that CVD is the leading cause of death in women, this awareness does not translate into perception of personal risk" ( p. 216). These findings highlight the need for women with broader range of ages to be included in research on CVD prevention and provided support for their inclusion in this thesis study.

Research has identified physical differences in the way in which women develop CVD. From an anatomical standpoint, women generally have smaller coronary arteries than men, with less collateral circulation; therefore, if atherosclerosis develops, they are more prone to positive vessel remodeling and unstable plaque formation (Cilla, Peña, Martínez, & Kelly, 2013; Murphy, Alderman, Voegelé Harvey, & Harris, 2017). Reynolds and colleagues (2011) performed

intravascular coronary ultrasound on a sample of women (N=50) admitted to hospital with non-obstructive CVD and found that plaque erosion and vasospasm were likely mechanisms behind these infarctions. Further studies have shown that women are also more likely to experience non-atherosclerotic conditions that limit blood flow, such as microvascular dysfunction, endothelial dysfunction, and coronary artery spasm (Kawamoto, Davis, & Duvernoy, 2016; Malecki-Ketchell, 2017; Murphy et al., 2017). These types of changes affect smaller diameter vessels and are often not visible on the traditional angiographic exam (Abdelmoneim et al., 2013); consequently, women who present with abnormal cardiac findings are frequently misdiagnosed with panic disorders, stress, or hypochondria (Paine et al., 2016).

Recent research is showing that men and women also differ in how they present with CVD. Women are less likely than men to present with chest pain and more likely to present with atypical symptoms, such as fatigue, pain that radiates to jaw, throat, and arms, nausea/vomiting, and lightheadedness (Kawamoto et al., 2016; Malecki-Ketchell, 2017). A lack of awareness regarding CVD symptoms that are specific to women has been associated with delayed presentation and inaccurate diagnosis (Bailey Merz et al., 2017). For example, Husser and Roberto (2009) interviewed a sample of older women with CVD (N=29) to learn about their perception of the disease. These women spoke of how initially they erroneously attributed the vague symptoms of CVD to other pre-existing conditions or to the general effects of aging.

The disparity that women at risk for CVD face extends to how they are treated by the health care system. Bailey Merz et al (2017) found that women are consistently assigned lower risk scores by MDs. Women are also less likely than men to receive preventative medical treatment, such as aspirin or lipid-lowering therapy (Garcia, Mulvagh, Merz, Buring, & Manson, 2016). They are also less likely to be referred for a diagnostic catheterization (Wenger, 2012).

When they do undergo this type of procedure, women experience higher rates of adverse events compared to men (Galbraith et al., 2011; Garcia et al., 2016; Kawamoto et al., 2016). Finally, once diagnosed with CVD women have poorer outcomes than men, including: lower one-year survival rates following first MI (Mozaffarian et al., 2016), double the operative mortality rates after CABG surgery (Vaccarino, Abramson, Veledar, & Weintraub, 2002), higher rates of treatment-related bleeding complications (Mehta et al., 2016), and greater risk of depression following MI and CABG (Nabi et al., 2010; Wyman et al., 2012). These findings further contribute to the need for research aimed at reducing CVD in women.

**Age.** Until fairly recently, CVD had been thought to primarily affect men; however, research is now showing that the risk of women developing CVD is equal to men by the time they reach the age of 65 years or older. Despite this knowledge, most women do not recognize CVD as a significant health threat that comes with aging (Garcia et al., 2016). This lack of awareness prevents women from addressing CVD risk factors during their younger years when this chronic disease is already beginning to develop (Haines, Patterson, Rayner, & Hyland, 1992). Promotion of healthy behavior is especially important in women since they develop CVD approximately ten years later than men, at an age when additional co-morbidities tend to develop, thus contributing to poorer outcomes for women (Schenck-Gustafsson, 2009).

As a person ages, the development of CVD is largely dependent on the acquisition of the known risk factors; however, age itself is also an independent risk factor for CVD (Dhingra & Vasan, 2012; Maas & Appelman, 2010). A man's risk of developing CVD increases after the age of 45, but a woman's risk increases after 55 or once she goes through menopause (Garcia et al., 2016; Maas & Appelman, 2010). Women experience unique physical changes in menopause and research has demonstrated that these changes can negatively impact the cardiovascular system.

For example, Woodard and colleagues (2011) examined data from the Women's Health Across the Nation Study (N=540) and found that during menopause, a drop in estrogen levels correlated with an increase in HDL and a decrease in LDL. These changes in lipid levels result in a higher concentration of total cholesterol, potentially leading to narrowed and blocked arteries.

Additionally, during menopause women experience a reduction in their overall metabolic rate and a loss in mean muscle mass. These changes are associated with the development of multiple CVD risk factors including obesity, hypertension, and diabetes (Stachowiak, Pertyński, & Pertyńska-Marczewska, 2015). For these reasons, as women approach menopause they should evaluate their health and address risk factors before the disease sets in (AHA, 2015).

**Body mass index.** An elevated BMI, a total body fat estimation based on a height/weight calculation, has been associated with an increased risk of CVD (Ball et al., 2016; Dudina et al., 2011; Katzmarzyk et al., 2012; Woodruff et al., 2017). From a physiological perspective, obesity leads to an increased total blood volume, which results in an increased workload on the heart (Akil & Ahmad, 2011). While men are more likely to be overweight, women are more likely to be obese, which is significant as the level of CVD risk increases in relation to the amount of excess weight a person carries (Elisha, Rabasa-Lhoret, Messier, Abdunour, & Karelis, 2013). Wilson and colleagues (2002) observed participants from the Framingham Heart Study (N=5,209) and found that obesity was more detrimental to a women's health, as this risk factor increased a woman's risk of CVD by 64% compared with 46% in men. One reason why women struggle with obesity may be explained by the decreasing estrogen levels that occur during menopause. In a systematic review, Lizcano and Guzman (2014) found that low levels of estrogen are associated with metabolic dysfunction, and the consequent development of obesity.

The presence of obesity also has an effect on whether or not a woman will engage in physical activity. Women are more likely than men to list obesity as a barrier to exercise (Ball, Crawford, & Owen, 2000). Several recent reviews of the literature found that obese individuals face additional barriers to exercise, including physical hurdles, such as limited mobility, general discomfort, pain, and injury, as well as psychological challenges like weight stigma, low mood, and lack of enjoyment (Buckley, 2016; McIntosh, Hunter, & Royce, 2016). There is also a perception that exercise is unsafe for obese individuals; however, research has shown that this population receives equal benefit from exercise as those who are not overweight (McIntosh et al., 2016). Additionally, obese women report delaying medical appointments until they have lost weight, reducing the chances of receiving helpful health behavior education (Bairey Merz et al., 2017). Finally, when obese women do interact with health care providers, the relevant health-promoting advice is often not tailored according to BMI (Bauer, Graf, Platschek, Strüder, & Ferrari, 2017). These findings highlight not only the significance of obesity as a CVD risk factor in women, but also the impact of obesity on the development of other CVD risk factors, such as physical inactivity.

**Frailty.** Frailty is generally characterized by a decline in physiological reserve, and a loss of homeostatic capabilities resulting in increased vulnerability to adverse health outcomes (Fried, 2001). There is no universally accepted measurement of frailty, despite over 20 scales having been developed in an attempt to quantify this concept (Gray, 2012). The two most popular instruments for measuring frailty are the Fried Frailty Phenotype (Fried, 2001), and the Frailty Index (Searle, Mitnitski, Gahbauer, Gill & Rockwood, 2008). The Fried Frailty Phenotype measures physical frailty through five measurable items: shrinking or weight loss, weak grip strength, slow gait speed, exhaustion, and low energy (Fried, 2001). The Frailty Index defines

frailty as a proportion of accumulated deficits or health concerns (i.e., incontinence, walking, cognition; Rockwood et al., 2011). The Fried phenotype is simple to use, whereas the Rockwood frailty index requires expertise in recognizing geriatric deficits but offers a more precise method of quantifying frailty (Maxwell & Wang, 2017). Most measures of frailty include a pre-frail category, which describes an intermittent stage between non-frail and frail in which some of the criteria for frailty are met (Sergi et al., 2015; Siriwardhana, Haroon, Weerasinghe, & Walters, 2018). In a systematic review of the literature, Collard, Boter, Schoevers, and Voshaar (2012) found that in research focused on community dwelling adults over the age of 65, the average frailty score was 10% (range 4%-59%) and the average pre-frailty score was 41.6%. Factors that have been correlated with frailty include: female gender, increasing age, living alone, poor socioeconomic status, and lower educational level (Aegerter, Arvieu, & Ankri, 2015; Herr, Robine; Hoogendijk, 2014).

***Frailty and cardiovascular disease.*** The relationship between frailty and CVD has been explored with varying results. In a review of four studies examining the cross-sectional association between frailty and CVD in community dwelling older adults, Afilalo (2011) reported that the prevalence of frailty is as high as 50%. In a recent meta-analysis of frailty-related research literature including a total of 31,343 older adult participants, Veronese et al., (2017) found that both pre-frailty and frailty were associated with increased risk of CVD; in fact, frailty was associated with a 3 times higher risk of death secondary to cardiovascular causes. In an analysis of cross-sectional data from the Longitudinal Aging Study Amsterdam (N=1432), Kleipool and colleagues (2018) found that older adults with CVD were twice as likely to be frail. However, in the same study, the reverse association was not found; frail patients were not at higher risk of CVD during three years of follow up (Kleipool et al., 2018). Sergi et al. (2015)

analyzed data from a population based cohort of Italian adults over the age of 65 years (N=3,099), and found that for each unit increase in Fried frailty score, there was an associated 25% increase in CVD risk. When examining the personal characteristics of women at risk for heart disease, frailty gives a better sense of aging than simply looking at a chronological number (Serrano, Garrido, Fuentes, Simon, Diaz, 2017). In addition, the presence of pre-frailty or frailty indicates a pathway of significant physical decline, which may negatively impact a woman's confidence to be physically active, and thus, was included as a potential predictor variable of self-efficacy.

### **Prior Related Behavior**

Research has demonstrated that prior exercise behavior can impact current levels of physical activity. Physical activity is a behavior often learned in childhood, and the strength of this initial adoption has been found to predict the continuance of this behavior into adulthood. In a review of the literature, which examined the tracking of physical activity over time, Telema (2009) found that this relationship was most predictive during the teenage years. Similarly, in a 10-year longitudinal study of Norwegian youth (N=630), Kjonniksen, Anderssen, and Wold (2009) identified that participation in organized sports during adolescence (age 13-16) was positively related to the frequency of leisure time physical activity in young adulthood. Finally, Belanger et al. (2015) analyzed data from a group of 637 teens, followed over a 13-year period and also found that the amount of time spent in sports during their teenage years correlated positively with adult physical activity levels. These studies highlight the importance of adopting physical activity in childhood in order to carry on this behavior into later life.

Research on exercise behaviors in young girls has identified some concerning trends that may explain adult women's exercise behaviors. Belanger et al. (2015) identified that a higher

proportion of boys than girls reported long-term participation in sports. Girls were more likely to engage in activities, such as fitness and dance; however, involvement in these types of activities was not correlated with physical activity in early adulthood (Bélanger et al., 2015). In a longitudinal study of American girls (N=2,000) from ages 9-10 through 18-19 years; Madsen, McCulloch, and Crawford (2009) found that activity levels in girls were highly influenced by how active they perceived their parents to be. Girls who reported that their parents exercised regularly were 50% more active than those who described their parents as sedentary (Madsen et al., 2009). In a systematic review of the literature exploring the determinants of physical activity in children, Hasketh et al. (2017) identified that maternal role-modeling was positively associated with physical activity in children. These findings highlight the need for research exploring ways to increase physical activity levels in females of all ages.

Past behavior has both direct and indirect effects on the likelihood of future exercise behaviors (Pender, 2015). The direct effect of past behavior is the habit formation that comes with performing the same behavior repeatedly (Phillips & Gardner, 2016; Tappe & Glanz, 2013). Phillips et al. (2016) studied a sample of college students (N=500) and found that habit strength could positively predict long term exercise behavior. Additionally, Kaushal and Rhodes (2015) noted in their survey of adult gym members (N=111) that habitual exercise was effective in reducing the challenges of maintaining this behavior over time. Verplanken and Melkevik (2008) remarked that “new or infrequent behavior requires mental effort and conscious thinking; this is less so when behavior is repeated” (p. 16).

Finally, prior behavior is thought to have a direct impact on current behaviors through an individual’s perceptions of the behavior, based on memories associated with past experiences (Pender, 2015). In a prospective, observational study of predominantly adult women (N=233),

Strachan, Perra, Brawley, and Spink (2016) examined exercise behavior during challenging times and found that past exercise behavior serves to strengthen self-efficacy beliefs for continuing that behavior when difficulties arise. In a systematic review of studies that aimed to increase self-efficacy for physical activity, Ashford, Edmunds, and French (2010) found that those interventions that provided participants with feedback of past performances produced the highest effect size. In a survey study of menopausal and postmenopausal women at risk for CVD (N=60), Smith-DiJulio and Anderson (2009) observed that lower self-efficacy for exercise may be related to limited exposure to sport in childhood. Thus, past behavior appears to be an important factor in understanding self-efficacy beliefs as they contribute to an individual's perception of a considered health behavior, such as physical activity.

In summary, women's risk for heart disease increases significantly during and after menopause, however many women are unaware of this increasing risk. Women have unique risk factors for CVD and experience some traditional risk factors differently than men. Women are also more likely to become obese after menopause, further contributing to their increased CVD risk and negatively impacting their physical activity behavior. Although women have longer life expectancies, they are more likely to become frail resulting in poor physical functioning and contributing to CVD risk. An older women's current physical activity level is largely dependent on whether she has built confidence in this behavior during her lifetime, and these behavioral patterns will significantly increase her CVD risk.

### **Behavior Specific Cognitions and Affect**

For the purposes of this thesis study, the relevant components of the HPM related to behavior specific cognition and affect include the perceived benefits of action, the perceived barriers to action, and self-efficacy beliefs related to physical activity.

### **Perceived Benefits of Action**

The perceived benefits of an action are the positive outcomes that an individual foresees will result from engaging in the considered behavior (Pender, 2015). These outcome expectations provide motivation to the individual and will influence the amount of effort they will expend on a health behavior (Bandura, 1977). Bandura argued that self-efficacy beliefs influence outcome expectations and not vice versa; however, Pender's model suggests a reciprocal relationship between the two concepts. The literature on outcome expectations related to the behavior of physical activity in populations at varying risk for CVD will be explored.

The perceived benefits of engaging in physical activity are numerous and vary with age. In a qualitative study of teenage girls (N=48), Borhani and colleagues (2017) reported that the perceived benefits of physical activity are both physical and psychological in this age group, including: improvement in physical appearance, feelings of joy, reduced stress, and increased self-confidence. In a large survey of healthy Australian adults (N=1,459), the positive outcomes of exercising were listed in physical terms: improved fitness, improved physical appearance, and improved energy levels (Rundle-Thiele, Kubacki, & Gruneklee, 2016). However, Wojcicki, White, and McAuley (2009) administered an outcome expectations for exercise scale on a predominantly female sample over the age of 55 (N=320) and found that these older individuals reported outcome expectations for exercise that were largely social, such as meeting new people, being with friends, and companionship. These findings suggest that individuals may approach exercise for different reasons at the various stages of their lives.

The outcome expectations of women at risk for CVD are unique and should be considered when developing strategies for the promotion of physical activity. Older adults have been found to be more highly influenced by social outcome expectations when considering

exercise behavior (Renner, Spivak, Kwon, & Schwarzer, 2007); this is important as women generally develop CVD later in life when they are more likely to be socially isolated. In a literature review of correlates of adult participation in physical activity, Trost and colleagues (2002) found that social support was strongly associated with physical activity in women. Women commonly list social support as an outcome expectation of participating in physical activity (Smith, Banting, Eime, O'Sullivan, & van Uffelen, 2017; Moreno & Johnston, 2014). Another unique outcome expectation related to reasons for engaging in physical activity cited by women at risk for CVD is the opportunity to be a role-model to their children (Joseph et al., 2017), highlighting the altruistic motivation that some women considering physical activity may experience.

### **Perceived Barriers to Action**

Barriers consist of a person's perceptions of the potential hurdles that must be overcome in order to engage in a proposed behavior (Pender, 2015). Barriers can be emotional, physical, or psychological and often stem from previous experiences with a similar behavior. Research has identified common barriers that are encountered in relation to the behavior of physical activity including: fatigue, and lack of time, skill, transportation, and motivation (Ansari & Lovell, 2009; Borhani et al., 2017; Maruf, Ojukwu, & Akindele, 2017). An important consideration when approaching a new behavior is the balance between barriers and benefits, because if the barriers are high and the benefits are low the behavior will not likely be attempted (Pender, 2015).

Women have been found to have unique barriers related to physical activity. These barriers are important to consider in understanding the population of women at risk for CVD (Clark et al., 2013; Sanderson, Shewchuk, & Bittner, 2010). In an intervention using text messaging to enhance physical activity in working women (N=87), women listed family

responsibilities as a major barrier to exercise (Gell & Wadsworth, 2015). As women age they are more likely to live alone and to have a lower income; therefore, the barriers of safety, transportation, and lack of social support are common (Gell & Wadsworth, 2015; McArthur, Dumas, Woodend, Beach, & Stacey, 2014). Finally, in a qualitative study of middle aged American women (N=20), Gothe and Kendall (2016) found that since older women are more likely to have multiple co-morbidities, they commonly list pain and fatigue as barriers to exercise (Gothe & Kendall, 2016; Mason, Horvat, & Nocera, 2016; Sutton et al., 2012). As women consider physical activity, the benefits of engagement must be stronger than the perceived barriers to participation. This balance becomes increasingly challenging to overcome as women age because they start to encounter a growing number of obstacles.

### **Perceived Self-Efficacy**

Self-efficacy is the judgment of one's personal capability to carry out the specific actions that regulate a desired behavior (Bandura, 1997). Research has shown self-efficacy to be the most consistent correlate of physical activity behavior in adult populations (Daley, Fish, Frid, & Mitchell, 2009; Dolansky, Zullo, Boxer, & Moore, 2011; Duncan, Rodgers, Hall, & Wilson, 2011; Gallagher, Clarke, & Gretebeck, 2014); however, the evidence related to self-efficacy as a predictor of physical activity is less convincing; therefore, self-efficacy was chosen as a variable of interest in the proposed study. The following section will determine the current evidence on self-efficacy in the context of the thesis study population of women at risk for CVD. The relationship between self-efficacy and the key study variables (i.e., age, BMI, physical activity, physical fitness, expectation outcomes) will also be examined in order to ascertain the current evidence related to how these variables influence a woman's confidence in her own abilities to be physically active.

***Self-efficacy in health promotion.*** Self-efficacy has been studied within the field of health promotion and has been found to be one of the most consistent correlates and determinants of health behavior (Ekkekakis, 2013). Of relevance to the current study, self-efficacy has been shown to predict health behaviors that are known to reduce the risk of CVD, such as: hypertension management (Daniali, Eslami, Maracy, Shahabi, & Mostafavi-Darani, 2017; Tavakoly Sany et al., 2017), weight loss (Artinian et al., 2010; Daniali et al., 2017; Oguma & Shinoda-Tagawa, 2004), diabetes management (Gell & Wadsworth, 2015; L M Hays & Clark, 1999; Kowall et al., 2017; Vanden Bosch et al., 2015), and physical activity adoption (Ashford et al., 2010; Buckley, 2016; Higgins, Middleton, Winner, & Janelle, 2014). Furthermore, self-efficacy has been shown to be a reliable construct related to health promotion in a variety of populations including middle-aged adults (Janssen, Dugan, Karavolos, Lynch, & Powell, 2014; Edward McAuley, 1992), older adults (Fanning et al., 2017; Shin et al., 2011; Yang, Jeong, Kim, & Lee, 2014), and women (Blanchard et al., 2015; Brennen & Williams, 2013; Edwards & Sackett, 2016). These findings suggest that self-efficacy is an appropriate determinant of health behavior to explore in a study of women at risk for CVD.

***Self-efficacy in health promotion in cardiovascular disease.*** Self-efficacy has been studied in populations at risk for CVD, most commonly in the context of exercise interventions. Self-efficacy has been shown to predict both enrollment in and adherence to these types of programs. For example, in a study of male and female adults (N=115) who participated in a 8-week walking program, self-efficacy was associated with both enrollment and compliance (Jerome & McAuley, 2012). Similarly, Ljung et al.(2012), conducted qualitative interviews with men and women (N=19) who attended a treatment group aimed at preventing CVD through the adoption of healthy behaviors, including exercise. They found that attendance strengthened self-

efficacy and concluded that self-efficacy was as “a factor which could be the key for achieving long-term behavioral change.” (Ljung, Olsson, Rask, & Lindahl, 2013, p. 384). In a longitudinal study, Bergstrom et al (2015), followed men (N=377) over a period of 13 years and found that self-efficacy for exercise was strongly associated with physical activity levels and negatively associated with the development of CVD. In contrast, Schneider et al. (2011), reported that when older adults (N=332) participated in a cognitive behavioral program, there was no change in either exercise self-efficacy beliefs or physical activity levels. These findings support the need for further research in this area.

*Self-efficacy in women at risk for cardiovascular disease.* Exercise self-efficacy beliefs have also been studied on the population of women at risk for CVD. Yang et al. (2013), performed a secondary analysis on data collected from elderly, low-income, Korean women (N=234) and found that strong self-efficacy beliefs were associated with stronger self-care behaviors including regular exercise. Self-efficacy beliefs have also been shown to be consistently correlated with exercise behavior over time; Janssen and colleagues (2014) examined self-reported physical activity data collected from sedentary, middle aged American women (N=90) over a 15-year time period and found that stronger self-efficacy beliefs were associated with sustained levels of physical activity. Interventions aimed at strengthening self-efficacy beliefs have also been described; Duncan et al (2011) used guided imagery to build self-efficacy for exercise beliefs in a sample of young, sedentary women (N=205). They found that an intervention based on the SCT was able to strengthen the three types of self-efficacy that are known to be important in the adoption of exercise behavior: task self-efficacy, coping self-efficacy, and barrier self-efficacy. Similarly, Daniali (2017) studied overweight and hypertensive Iranian women who participated in an exercise intervention and found a significant improvement

in self-efficacy and physical activity levels at a 6 month follow up. These studies support the role of self-efficacy in influencing exercise behavior in women; however, it is clear that research is lacking on Canadian women over the age of 55, a gap that was addressed by this thesis study.

*Self-efficacy in populations with cardiovascular disease.* Although this thesis project focused on women at risk for CVD, the self-efficacy beliefs in populations with CVD were also considered. The rationale for including this perspective is that there is an extensive body of literature on the exercise self-efficacy beliefs of adults attending CRP and knowledge from this population may provide insight into populations at risk. Researchers have found that self-efficacy for exercise can predict both intention (Dohnke, Nowossadeck, & Müller-Fahrnow, 2010) and motivation to participate in CRP interventions (Frank, McConnell, Rawson, & Fradkin, 2011). Some researchers have found that strong exercise self-efficacy beliefs at the outset of the CRP correlated with increased levels of exercise behavior measured two years after the CRP (Bennett, Adams, & Ricks, 2012; Burns & Evon, 2007). Interestingly, self-efficacy beliefs have also been shown to decline over the course of the CRP; in other words, these beliefs are strongest at the outset of the program, suggesting that participants may hold unrealistic expectations of their own abilities when they start the program (Blanchard et al., 2007; Howarter, Bennett, Barber, Gessner, & Clark, 2014). However, not every study has supported the relationship between self-efficacy and exercise in the CRP context. For example, Murray and Rodgers (2012) found that exercise self-efficacy did not change during participation in CRP. Similarly, Hornberg et al. (2017), found that exercise behavior did not improve with participation in an CR intervention aimed at strengthening self-efficacy beliefs. These conflicting findings suggest that further research needs to be done in order to confirm the role of self-efficacy in a physical activity program.

*Exercise self-efficacy.* Some researchers have suggested that exercise self-efficacy is multi-dimensional and to adopt this type of behavior requires confidence in multiple sub-skills including task self-efficacy, scheduling self-efficacy, and barrier self-efficacy (Rodgers & Sullivan, 2001; Duncan, Rodgers, Hall, & Wilson, 2011). Additionally, these different types of self-efficacy may be more important at different times in the adoption process. Several studies found that task self-efficacy increases over the course of an exercise intervention and correlates positively with physical activity (Faulkner, Westrupp, Rousseau, & Lark, 2013; Frank et al., 2011; Rodgers, Murray, Selzler, & Norman, 2013). However, Murray and Rodgers (2012) found that task self-efficacy declined over the duration of a CRP. In a similar study of CRP participants (N=63), Rodgers et al. (2013) reported that task self-efficacy was a poor predictor of behavior and the least predictive type of exercise self-efficacy. These findings suggest that becoming physically active is more complex than simply being able to perform the behavior.

The findings related to scheduling self-efficacy in the context of physical activity have also been varied. Murray and Rodgers (2012) found that this type of self-efficacy was the strongest predictor of long term physical activity in a sample of primarily male adults (N= 107) participating in a CRP. Woodgate and Brawley (2005) demonstrated that scheduling self-efficacy could be strengthened through verbal persuasion in a predominantly male sample (N=54). Rodgers et al. (2013) reported that in a group of primarily male adults (N=63), scheduling self-efficacy was the strongest predictor of exercise behavior one month post CRP. These findings indicate that scheduling self-efficacy may be important for longer term adherence to physical activity in a male population; however, literature appears to be lacking on the scheduling self-efficacy beliefs of women related to physical activity.

Barrier self-efficacy has been found to be important at different times in the behavior adoption trajectory. In a prospective cohort study, D'Angelo et al. (2014) found barrier self-efficacy to be most relevant in the first two months of beginning an exercise behavior in predominantly male patients with CVD (N=800). Similarly, Burns and Evon (2007) noted that barrier self-efficacy was most important at the outset of CRP in adult males (N=79). Dolansky and colleagues (2010) performed a secondary analysis on adults in a CRP (N=248) and found that in those who began the program with low barrier self-efficacy, self-efficacy continued to decline over the course of the program. The authors concluded that either this type of confidence was not being strengthened by participation, or that barriers were being encountered to challenge this type of self-efficacy (Dolansky et al., 2010). Rodgers et al. (2013) found that barrier self-efficacy did not change over the course of CR in a sample of predominantly male participants (N=63). This research suggests that confidence to exercise in the face of obstacles is important for successful behavior adoption in men, but more research is needed to explore if this is also true for women.

*Measuring self-efficacy.* Although Bandura (1997) described self-efficacy beliefs as behavior specific, Schwarzer and Jerusalem (1995) created the General Self-Efficacy Scale to measure, “a general sense of perceived self-efficacy with the aim in mind to predict coping with daily hassles as well as adaptation after experiencing all kinds of stressful life events” (Luszczynska et al., 2005). This scale has had limited use in the study of physical activity behavior with only two studies being identified on the topic. Poortaghi and colleagues (2013) conducted a randomized controlled trial on adults (N=80) attending CRP with half of the sample receiving multiple home-visits by a nurse, which was considered a form of verbal persuasion. The results indicated that those in the intervention group had higher levels of general self-

efficacy then those in the control group following completion of the CRP. Miao, Gan, Gan, and Zhou (2017) conducted a longitudinal study examining the health behavior of a sample of Chinese adult employees (N=706) and found that general self-efficacy had a positive influence on self-efficacy for physical activity over a four-week period.

Self-efficacy has been measured in a variety of ways in physical activity research. The majority of studies on this subject are based on physical activity interventions; therefore, exercise self-efficacy is frequently measured. Barkley and Fahrenwald (2013) measured both exercise self-efficacy and barrier self-efficacy in a group of adults attending an exercise intervention. Woodgate and Brawley (2008) measured scheduling self-efficacy in adults attending an exercise program. Similarly, Buckley (2016) used a three item exercise self-efficacy questionnaire, which focused on participants' confidence to schedule and organize regular exercise activity. Finally, Jerome and McAuley (2013) assessed self-efficacy to exercise despite being faced with barriers, in a group of adults attending a CRP (N=65) using McAuley's Exercise Self-Efficacy Scale (2003) and Barriers to Exercise Self-Efficacy Scale (1992). These studies identify that various types of self-efficacy are important in the adoption of exercise behavior and support the use of a multidimensional tool to measure this concept.

Several physical activity studies have reported the sex specific exercise self-efficacy beliefs of women with CVD, using a variety of tools. Janssen, Dugan, Karavolos, Lynch and Powell (2014) used the Self-Efficacy and Exercise Habits Survey (Sallis, Pinski, Grossman, Patterson, & Nader, 1988), a 12-item questionnaire assessing confidence to overcome barriers to exercise, in a sample of middle-aged American women (N=90). They found that women who reported strong exercise self-efficacy maintained higher levels of physical activity over a 15-year

time period than women with low exercise self-efficacy. Rodgers and colleagues (2008) studied three types of exercise self-efficacy beliefs (i.e., task, scheduling, and coping) in three groups of predominantly female (N=395, N=470) and entirely female (N=58) participants of varying ages, using the Multidimensional Self-Efficacy for Exercise Scale. These studies found that different types of exercise self-efficacy were important at different times in the adoption and adherence of this type of behavior. Dolansky et al., (2010) used McAuley's (1993; 1992) Barrier for Self-Efficacy Scale in a sample of men and women (N=248) participating in a 12 week CRP and found that in both genders self-efficacy for exercise decreased over the course of the program. Similarly, Costanzo and Walker (2008) used the Barrier for Self-Efficacy Scale and found that self-efficacy for physical activity declined in women who participated in a one-time intervention aimed at increasing physical activity. Blanchard et al. (2007) studied 801 adults (604 men and 197 women) with CVD and compared the Barrier for Self-Efficacy scores of those who chose to attend CRP vs those who did not. Both men and women reported declining barrier related self-efficacy beliefs during the CRP. Costanzo and Walker (2008) found that women who participated in five sessions aimed at increasing physical activity reported no change in their self-efficacy for physical activity; furthermore, no correlation was found between baseline self-efficacy and exercise at 12 weeks. These inconsistent results confirm the need for further research on the specific exercise self-efficacy beliefs of women and further support the use of a reliable and valid tool that examines various types of exercise self-efficacy.

*Self-efficacy and key study variables.* In the HPM, personal characteristics are proposed to affect behavior patterns through their indirect impact on cognitive perceptions. The demographic variables of age, body mass index, and frailty will be explored in relation the cognitive process of self-efficacy in order to understand the influence that these factors might

produce. Additionally, the concept of outcome expectations will be examined in relation to self-efficacy in order to understand if the perceived benefits associated with exercise will have an impact on exercise self-efficacy. These comparisons will be made in the context of previous literature in order to establish what is currently known about these variables.

*Self-efficacy and age.* The relationship between age and exercise self-efficacy is not consistent in the literature and it is not clear whether or not exercise self-efficacy beliefs alter with age. For example, Noritake et al. (2010) studied a sample of frail older adults (N=72) taking part in a 6-week exercise program and found that participation was associated with significant increases in exercise self-efficacy beliefs. Likewise, Renner and colleagues (2007) studied a group of older South Korean adults (N=697) who participated in a health study and found that exercise was positively associated with self-efficacy. However, these findings were not supported by Constanzo and Walker (2008) who examined the effect of behavioral counselling sessions on a sample of older women (N=51) and found that this intervention had no influence on exercise self-efficacy beliefs. Similarly, Kosteli, Cumming, and Williams (2018) tested the effect of exercise guided imagery on a group of older adults (N=299) and did not find a significant relationship between self-efficacy and physical activity. This mixed evidence provided additional support for this thesis study. Furthermore, the majority of previous research was carried out on both male and female samples; therefore, further research is needed to understand the self-efficacy beliefs in the unique population of older women.

*Self-efficacy and body mass index.* The relationship between obesity and exercise self-efficacy in adults at risk for CVD has not been extensively studied with few research articles identified on this subject. Bukley (2016) studied the effects of a tailored intervention on the exercise self-efficacy beliefs in both active and inactive overweight and obese women (N=97).

After 12 weeks, the participants in the previously inactive group showed improvement in their self-efficacy beliefs, while the previously active group reported no change. Annesi (2011) studied a sample of severely obese adults (N=183) who participated in a 26-week exercise program and found that improvements in exercise self-efficacy scores significantly predicted changes in exercise behavior. In a systematic review of studies that examined obese adults participating in interventions aimed at increasing self-efficacy for exercise, overall a non-significant relationship was found between change in self-efficacy and physical activity (Olander, et al., 2013). The lack of consensus between these findings indicates the need for further research to better understand the association between self-efficacy and body mass index. As previously noted, women face particular challenges in relation to weight gain and these findings suggest that this risk factor may negatively influence self-efficacy for physical activity.

*Self-efficacy and frailty.* Doba and colleagues (2016) completed a cross-sectional study of a predominantly female sample of older Japanese adults (N=257) to determine the predictors of frailty. Based on a linear regression analysis, which included a number of parameters including gender, age, strength, memory, cognition, and general self-efficacy, only general self-efficacy was a significant predictor of frailty. In a population-based cohort study, with a sample of middle aged and older German adults (N = 3,124), Boehlen et al. (2017) found that frailty was associated with significantly lower levels of general self-efficacy. Matsuda, Shumway-Cook, and Ciol (2010) carried out a 6-week exercise intervention on a predominantly female sample of frail older adults (N=72) and found that participation in the program was associated with significant improvement in exercise self-efficacy. These results suggest that frailty may have an impact on self-efficacy beliefs related to physical activity, however, the lack of research in this area supports the need to include the concept of frailty in this study.

*Self-efficacy and outcome expectations of physical activity.* The concept of outcome expectations is part of Bandura's SCT (1986), yet it has received little research attention in the area of behavioral outcomes of physical activity. Considering that many health care interventions focus on delivering education about the positive outcomes of physical activity, this concept deserves further attention. Although Bandura (1997) argued that self-efficacy influences outcome expectations of physical activity and not vice versa, the relationship between self-efficacy and outcome expectations of physical activity is not consistent in the literature. No studies were identified that specifically measured the effect of one variable on the other; however, several studies measured the parallel effects of self-efficacy and outcome expectations on physical activity. Hays and Clark (1999) surveyed older adults with type 2 diabetes (N=260) using a questionnaire that included 3 items to measure task self-efficacy and another 3 items to assess beliefs that exercise would positively affect health. They found that while self-efficacy was positively correlated with physical activity behavior, outcome expectations were not. Similarly, in a review of the literature examining predictors of physical activity (Rhodes & Quinlan, 2015), found that the majority of studies demonstrated a moderate to strong relationship between strong self-efficacy beliefs and physical activity but only one study identified a positive relationship between outcome expectations and physical activity. A large body of research has focused on the exercise behaviors of adults participating in organized exercise programs, such as CRP. Many of these studies use the SCT as a guiding framework, including measurements of both self-efficacy and outcome expectation beliefs. Blanchard et al., (2011) surveyed a sample of predominantly white men (N=280) at baseline and then 3 months into a CR program and found that both self-efficacy beliefs and outcome expectations improved with program attendance and both were positively correlated with physical activity behavior. Blanchard and colleagues

measured outcome expectations for physical activity with the Outcome Expectations Questionnaire, a 7-item questionnaire developed from CRP patient focus groups and tested in similar research (Blanchard et al., 2015; Blanchard et al., 2003; Blanchard, Courneya, et al., 2002; Blanchard, Rodgers, Courneya, Daub, & Black, 2002). Similar results were reported by Flora and colleagues (2015) in a small CRP sample of adult males (N=49) using a 14 item tool to assess both the positive and negative outcomes associated with exercise. Sweet and colleagues (2011) also studied a group of mostly white males (N=251) using the Expected Outcomes and Barriers for Physical Activity Scale (Steinhardt & Dishman, 1989) and found that outcome expectations and self-efficacy beliefs did not improve with CR attendance; however, there was a positive relationship between both variables and level of physical activity. Conversely, Ghisi (2015) and colleagues conducted a quasi-experiment on a primarily male cohort attending a CRP (N=306) and measured outcome expectations for physical activity using a 3 item questionnaire focused on the social, psychological, and physical benefits of exercise. Although attendance was found to increase self-efficacy and outcome expectation beliefs, these improvements did not translate into behavior changes. This research suggests that like self-efficacy, outcome expectations may be positively associated with exercise behavior; however, because this relationship is not consistent in the existing literature and most of this research was completed on male samples, there is a need for further research in this area.

Only a small body of research literature focuses on the specific outcome expectations of women related to physical activity. Matsuda, Shumway-Cook, and Ciol (2010) studied the effects of a home-based exercise program on a primarily female sample of frail, older adults (N=72). They found that participation in this intervention was positively associated with improvements in both outcome expectations and self-efficacy beliefs related to physical activity.

Outcome expectations were measured using a single question from the Outcome Expectation for Exercise Scale (Resnick, Zimmerman, Orwig, Furstenberg, & Magaziner, 2000). Blanchard, Arthur, and Gunn (2015) completed a latent class growth analysis from data on a study of Canadian women (N=203) attending CRP and found that those with strong self-efficacy beliefs and outcome expectations were most likely to maintain physical activity during and after the program. The previously described, Outcome Expectation Questionnaire was used to measure outcome expectations in this study.

Conversely, in a prospective cohort study of older, low income women (N=190) referred to a free exercise program, Hays and colleagues (2010) found that self-efficacy and outcome expectations were not significantly associated with exercise participation. Outcome expectations were measured using three items that assessed beliefs that exercise would positively affect their health. Wilcox, Castro, and King (2006) studied a group of older women (N=118), participating in a yearlong exercise intervention and found that baseline outcome expectations for exercise did not predict physical activity participation at 6 months and at 12 months. Outcome expectations were measured in a questionnaire that asked participants to rate the extent to which 16 items would change over 6 months if they participated in the exercise program (King, Taylor, Haskell, & DeBusk, 1989). These inconsistent findings lend support for further research in this area.

In summary, aging women consider socialization to be an important benefit of engaging in physical activity. Women describe unique barriers to exercise including prioritizing family needs and difficulties related to aging. Self-efficacy has been found whether an individual will adopt and maintain exercise behavior in a variety of populations including women. Research has shown that efficacy in multiple behaviors is required at different points in the exercise adoption process and they include; task self-efficacy, barrier self-efficacy, and scheduling self-efficacy. A

small body of research suggests that as women age, the relationship between self-efficacy and physical activity continues to be important but further investigation is needed on this topic.

### **Behavioral Outcomes**

This section will discuss the key outcomes of physical activity in women. As discussed in the previous chapter, engagement in physical activity has been shown to significantly reduce the risk for CVD and is therefore the primary outcome variable for this thesis study. The following literature review highlights the physical, social and psychological outcomes of physical activity.

### **Physical Outcomes**

Physical activity has been shown to positively impact all of the major modifiable risk factors associated with CVD. Research has demonstrated that adults who engage in regular physical activity experience reductions in blood pressure (Booth, Roberts, & Laye, 2012; Frank et al., 2011; Myers, 2003; Whelton, Chin, Xin, & Jiang, 2002), and a decrease in total cholesterol (Devore et al., 2014; Lima et al., 2014; Philippou et al., 2018). In a 20-year longitudinal study, Hankinson and colleagues (2010) followed adults over the age of 18 (N=3,554) and found that maintaining high levels of physical activity had a significant impact on controlling weight gain over time, especially in females. Similar results were reported in two longitudinal studies focused on diabetic care: Diabetes Prevention Program (DPP; Knowler et al., 2002) and Look AHEAD (Action for Health in Diabetes; Sunyer, 2007), which found that physical activity interventions contributed to reduced blood pressure, reduced cholesterol, weight loss, and improved physical conditioning in samples of adults with pre-diabetes (N=3,234) and diabetes (N=5,145), respectively.

Current evidence-based physical activity guidelines of 150 minutes/week of moderate-vigorous intensity physical activity describe the amount and intensity of physical activity needed for optimal benefits (Canadian Society for Exercise Physiology, 2011). These findings are supported by several large studies. In a prospective cohort study of sixty-year-old Swedish adults (N=4,232), Ekblom et al. (2014) found that participants who had high levels of non-exercise physical activity (i.e.: cutting the lawn, car maintenance, fishing) demonstrated a 27% reduction in risk of cardiac events regardless of regular exercise habits. Similarly, Manson and colleagues (2002) reported on longitudinal data from the Women's Health Initiative Observation Study and found that in a large and ethnically diverse sample of women (N=73,743), brisk walking or vigorous exercise for 2.5 hours a week resulted in a risk reduction of approximately 30%. These findings suggest that any form of moderate physical activity is beneficial in reducing CVD risk in female populations.

In 2001, Kohl wrote a synthesis of current literature examining the relationship between physical activity and CVD in data from five large cohort studies. He noted that there was an inverse association between physical activity intensity/duration and the incidence of CVD (Kohl, 2001). This finding is relevant for the current thesis study population because as mentioned in previous sections, women engage in less physical activity and at lower intensity levels than men. Research shows that risk reduction improves with the amount of physical activity performed. In a prospective cohort study, Soares-Miranda et al. (2016) followed American adults (N=4,207) over ten years and found that increased amounts of walking were associated with lower risk of CVD. Oguma and Shinoda-Tagawa (2004) conducted a meta-analysis on studies examining the dose-response relationship between physical activity and CVD in women. They found that women experienced a CVD risk reduction with as little as one hour of walking a week;

additionally, higher levels of physical activity were found to not be harmful in women (Oguma & Shinoda-Tagawa, 2004). These findings support the goal of this study, to further understand the beneficial role of physical activity in promoting CVD risk reduction in women.

### **Social Outcomes**

The social benefits of physical activity are especially important to consider in women, as a lack of social support has been linked to CVD risk in this population (Lori Mosca et al., 2011). In a literature review on the topic of social support and women's health, Ahmadi (2016) found that there are many reasons why social support can influence a woman's health including buffering stress, facilitating coping, and positively influencing patterns of health behavior. As previously discussed, women are more likely to experience social isolation as they age and this may influence their physical activity. Many studies have demonstrated a strong association between social support and physical activity levels in women. Larsen and Linke (2014) examined data from a nation health survey of American adults (N=33,326) and found that "those with more social support are more likely to engage in regular physical activity than those without social support" (p. 529). This type of approval from family and friends is both a motivator for engaging in activity and a benefit of participation. Kinnafick, Thogersen-Ntoumani, and Duda (2014) performed a qualitative study on previously sedentary women (N=20) participating in a physical activity intervention, and found that women with high program adherence described relying on social support from other participants. Similarly, Van Dyck and colleagues (2014) completed an observational study on adults (N=6,014) from three countries and found that perceived social support from family and friends was positively associated with physical activity, especially in women.

In a theoretically-based counselling intervention carried out on middle-aged adult women (N=40), Daley and colleagues (2009) found that women who exercised with a friend reported higher adherence rates to regular physical activity. Rapp and Schneider (2013) examined the impact of relationship status on adults (N=30,201) living in Germany and found that marriage was positively associated with physical activity levels in women. Of significance to the current study, Fraser and Rodgers (2010) surveyed a sample of adults (N=124) attending CRP at baseline and then one month later and found that social support was associated with all three types of self-efficacy for exercise (i.e., task, scheduling, barrier). Social support is an important outcome of engagement in physical activity, especially for older women whose health may be negatively affected by unwanted isolation.

### **Psychological Outcomes**

Depression has recently been found to be an independent risk factor for heart disease in women (O'Neil et al., 2016). Fortunately, physical activity has been shown to have a positive effect on mood and overall psychological well-being in adult populations (Hallam, Bilsborough, & de Courten, 2018; Johansson, Hartig, & Staats, 2011). In a literature review examining the likelihood of depression in adults who are physically active, Teychenne, Ball, and Salmon (2008) found that in the majority of studies even light-moderate amounts of exercise were protective against depression. Berlin, Kruger, and Klenosky (2016) surveyed a sample of women between the ages of 60-92 (N=256) who listed stress relief as a primary reason for participation in leisure time exercise. In a Cochrane review examining the question, "Is exercise an effective treatment for depression?" the reviewers concluded that exercise is associated with a greater reduction in depressive symptoms than placebo, relaxation, or meditation (Cooney et al., 2013). Similarly, in a systematic review by Josefsson, Lindwall, and Archer (2014), performed a systematic review

and reported that exercise had a significant effect on reducing the symptoms of depression. These findings highlight the importance of being positively motivated as a key component in successful exercise adoption.

### **Summary**

This literature review has explored the existing health promotion research on the topic of self-efficacy and physical activity in women at risk for CVD. Specifically, relevant evidence related to individual characteristics and experiences, as well as behavioral cognitions, affect, and behavior outcomes being explored in the current study. This review highlighted that women are at particular risk for CVD due to a number of factors, including, unique risk factors, non-traditional symptoms, social isolation, and increased rates of depression. Importantly, lower levels of physical activity across all age groups were identified as contributing significantly to women's risk for CVD. Research on the role of self-efficacy and physical activity was explored as increased levels of physical activity are related to lower CVD risk. Although self-efficacy was consistently found to be positively associated with physical activity in various adult populations, little evidence was found on the population of interest: middle aged and older Canadian women. Considerable research identified that multiple types of self-efficacy are needed to successfully engage in and sustain physical activity, lending support to the use of several measures of self-efficacy in the thesis study. Although the relationship between outcome expectations and physical activity has been explored, these findings were not consistent and few studies have focused women. Therefore, this review has identified that further research is needed to understand the specific exercise self-efficacy beliefs of women at risk for CVD; this knowledge may inform future health promotion strategies to support this vulnerable population.

## **CHAPTER FOUR: METHODOLOGY**

This chapter will describe the methods and procedures that were used to explore the variables of interest in this thesis project. The design, setting, and sample will also be discussed. As well, the plan for data analysis and ethical considerations will be outlined.

### **Research Design**

This study was part of a larger study entitled “The Heart Attack Prevention Program for You (HAPPY) Hearts Health Promotion Program” (HHHPP), an interventional arm of a prospective, observational study called the HAPPY Hearts Study (HHS). The purpose of the parent study (HHS) was to establish a cardiovascular health-screening program for women and to test how well a new cardiovascular screening program for women works to detect cardiovascular events over a five-year period. The HHHPP used a randomized-controlled trial design to determine if a health promotion intervention would improve the cardiovascular health of women identified as having a moderate-high risk of future cardiovascular events. The thesis project will use a retrospective, correlational design using data collected from the larger HHHPP study.

### **The Setting**

The HHHPP study was conducted in Winnipeg, Manitoba, Canada. Data were collected at the St. Boniface Hospital.

### **The Sample**

Participation in the HHHPPP was open to women who were identified as having moderate-high risk of future cardiovascular events based on the 4-test screening in the HHS. Specific inclusion criteria were: women aged fifty-five or older and residents of Manitoba. Exclusion criteria included women with previous hospitalization for ischemic heart disease, acute MI, stroke, percutaneous coronary intervention, CABG, congestive heart failure,

hypertension, or peripheral artery disease. Baseline data from the 120 women recruited for the HHHPP were used in the current study; this sample size provided the ability to detect correlations of 0.25 or higher between the study variables of interest with a power of 80% and a two-tailed alpha of 0.05.

### **Measurement Instruments**

Data for the larger study were collected using a combination of physical assessment tools and questionnaires (Boreski, 2017). Specific research instruments were used to operationalize the key concepts of the thesis project including: multi-dimensional exercise self-efficacy beliefs, general self-efficacy beliefs, cardiovascular risk, demographic/personal factors (i.e., age, BMI, frailty, physical activity, physical fitness), and outcome expectations.

### **Measuring Self-Efficacy**

#### **Self-Efficacy**

The General Self-Efficacy Scale (GSES; Jerusalem & Schwarzer, 1992; see Appendix A) was used to measure the broad concept of self-efficacy. This scale was developed to assess an individual's perceived sense of competence to cope with a broad range of challenging demand (Jerusalem & Schwarzer, 1992). In a multicultural validation study (N= 1,933), the GSES was found to have acceptable reliability with Cronbach's alpha over 0.8 (Luszczynska, Scholz, & Schwarzer, 2005). This same study also found that the GSES was positively correlated with optimism and negatively correlated with depression and anxiety. Based on the evidence from this study, Luszczynska et al., (2005) concluded that "general self-efficacy appears to be a universal construct that yields meaningful relations with other psychological constructs" (p. 439). The GSES has been used in predominantly female samples, such as a group of adults with chronic

illness and was found to have acceptable internal consistency with Cronbach's alpha of 0.92 (Daniali, Darani, Eslami, and Mazaheri, 2017).

The GSES is a 10 item scale with the stem "In my opinion." Participants are asked to give their opinion on the truth of 10 statements, according to a 4-point scale (i.e. 1=not at all true; 2= hardly true, 3= moderately true, 4= exactly true). The statements are all related to the amount of confidence felt in overcoming various obstacles (i.e., I can always manage to solve difficult problems if I try hard enough). All responses are summed for a total score between 10-40. The authors of this tool do not endorse a numerical range to classify high and low levels of general self-efficacy, rather the results should be interpreted on a continuum (Schwarzer & Jerusalem, 1995). A Flesch Kincaid assessment of the reading level of this tool found it to be at a grade level of 7.5 (Kupst et al., 2015), which is appropriate for the education level of this sample.

### **Measuring Exercise Self-efficacy**

The Multidimensional Self-Efficacy for Exercise Scale (MSES; Rodgers, Murray, Wilson, Hall, & Fraser, 2008) was used to operationalize the concept of exercise self-efficacy. This is a 9-item scale measuring the three exercise behavior sub-domains of task efficacy, coping efficacy, and scheduling efficacy, as outlined by Rodgers and colleagues (2008; see Appendix B). As discussed in chapter two and three, these three self-efficacy domains are believed to be important in supporting sustained physical exercise behavior. This scale was developed by Rodgers and colleagues (2008) and was originally tested in a series of three studies, two of which featured primarily adult female participants. Internal consistency was measured using Cronbach's alpha and was shown to be acceptable for each subscale: task efficacy= 0.81, coping efficacy=0.81, and scheduling efficacy=0.91 (W. M. Rodgers et al., 2008). Additionally, adequate test-retest reliability was demonstrated through Pearson's r values of 0.78, 0.83, and

0.80 respectively. This scale has been further tested in a number of studies featuring primarily Canadian women and has been shown to be a valid and reliable measure of task, coping, and scheduling exercise efficacy (Fraser & Rodgers, 2010; Murray, Rodgers, & Fraser, 2012; Rodgers et al., 2008; Rodgers, Markland, Selzler, Murray, & Wilson, 2014).

The MSES begins with the stem “How confident are you that you can”, followed by three items to represent task efficacy (e.g., “follow direction to complete the exercise”), coping efficacy (e.g. “exercise when you feel discomfort from exercise”) and scheduling efficacy (e.g., “include exercise in your daily routine”) components of exercise self-efficacy. Each question is assessed using a 10-point Likert-type scale ranging from one (no confidence) to ten (complete confidence). The authors of this tool do not define numerical categories for “high” vs “low” self-efficacy; therefore, the strength of this belief was assessed on a continuum. In the current project, the responses to the three items were summed and averaged to yield scores for each subscale, with a range of possible responses between 0 and 90. A summary exercise self-efficacy score was also calculated by adding all of the responses and calculating an average score. Readability was not found to have been assessed on this scale, however, the entire scale has only 3 words with 3 or more syllables and therefore, according to Simple Measure of Gobbledygook (SMOG) criteria for readability, this tool would be at a grade 5 reading level (McLaughlin, 1969).

***Measuring cardiovascular disease risk.*** CVD risk was measured using the adapted Rasmussen Disease Score (RDS) protocol (Cohn et al., 2003; see Appendix C). This risk assessment tool is described in detail by Boreskie (2017) in the published HHS study protocol. The adapted RDS protocol was developed at the Rasmussen Center for Cardiovascular Disease Prevention, in an effort to develop a more sensitive CVD screening program using non-invasive testing to identify structural abnormalities in asymptomatic individuals (Cohn et al., 2003). The

original RDS was composed of 10 measurements, four of which were utilized in the HHS. Correlation coefficients for individual test contributions to the total disease score were: 0.570 (resting blood pressure), 0.561 (small artery elasticity), 0.487 (exercise rise in blood pressure), and 0.403 (large artery elasticity; Duprez et al., 2011). In a regression analysis comparing the predictive values for morbid events, the Beta coefficient was higher for the RDS (0.655) than for the Framingham Risk Score (0.620) supporting the validity of this test (Duprez et al., 2011).

The RDS consists of four physical measurements: resting blood pressure, systolic blood pressure response to exercise, large artery elasticity, and small artery elasticity. Each of the four tests are scored as follows: 0=normal, 1=borderline, and 2 for abnormal results. Total test scores which can range from 0 to 8, are used to assign participants into one of two risk groups: 0-2 normal risk and  $\geq 3$  moderate to high risk. In the HHS, measurements were taken using the HD/PulseWave CR-2000 CardioVascular Profiling System (CV profiler). “This device is indicated for use in determining cardiovascular parameters in human subjects for research purposes only” (Boreskie, et al., 2017, p.4). This profiler has been shown to accurately measure both large and small artery elasticity (Zimlichman et al., 2005). Details of how each of the four tests were performed are described below.

Test 1: resting blood pressure. A blood pressure cuff attached to the cardiovascular profiler was placed on the participant’s arm while she was in a supine position. A blood pressure reading was taken after five minutes of rest. A reading of less than 120/80 mmHg was considered normal and given an RDS score of 0. A reading of 120-139/80-89 mmHg was considered pre-hypertensive and given an RDS score of 1. A blood pressure reading above 160 mmHg systolic or 105 mmHg diastolic was repeated after an additional five minutes of rest. If

the blood pressure continued to exceed these measurements, a healthcare provider was contacted to provide medical clearance before the participant performed physical activity.

Test 2: systolic blood pressure response to exercise. After the resting blood pressure was assessed, the participant was asked to perform three minutes of moderate exercise according to the Dundee Step Test (Lim, Shiels, Anderson, & MacDonald, 1999), or on a treadmill for those unable to climb stairs. Both of these exercise procedures required the participant to exercise at a five metabolic-equivalent workload. Immediately upon completion of this exercise, the participant returned to the cardiovascular profiler and a blood pressure measurement was taken in a supine position. A rise in the systolic blood pressure of under 30 mmHg and a peak blood pressure of less than 169 mmHg was considered normal and given an RDS of zero. A rise in systolic blood pressure of 30-39 and an absolute resting blood pressure of 170-179 mmHg was considered borderline and given an RDS of 1 point. Finally, a rise in systolic blood pressure of 40 mmHg or higher and an absolute resting blood pressure of 180 mmHg was considered abnormal and was scored a RDS of 2. All participants with abnormal blood pressure responses to exercise were advised to speak with their primary care provider regarding this finding.

Test 3 & 4: large and small artery elasticity. To measure artery elasticity, a wrist stabilizer was placed on the participant's wrist while she was lying in a supine position. A pulse wave sensor was then placed over the location of the strongest radial pulse taken near the wrist. A blood pressure cuff was applied to the participant's opposite arm. The CV profiler then took a series of readings simultaneously through the wave sensor and the blood pressure cuff. Using a modified Windkessel model, small and large artery elasticity can be established (Boreskie et al., 2017). Scoring of the large and small arterial elasticity was based on criteria established by Duprez, Florea, and Wong (2011). For females under the age of 65 years, a large artery elasticity

of 10 ml/mmHg or greater was normal (0 RDS points), a value of 9 to 9.9 mmHg x10 was considered borderline (1 RDS point), and any value below 9 ml/mmHg X10 was considered abnormal (2 RDS points). The small artery elasticity cut-offs for this range was 4 ml/mmHg x100 for normal (0 RDS points), 3.5-3.9 ml/mmHg x100 for borderline (1 RDS point), and under 3.5 ml/mmHg x100 for abnormal (2 RDS points). Females over the age of 65 years have lower cut-offs for both large and small artery elasticity compared to the category described above. Normal large artery elasticity values were 9 ml/mmHg x10 or higher (0 RDS points), borderline values were 8-8.9 ml/mmHg x10 (1 RDS point), and abnormal values were under 8 ml/mmHg x10 (2 RDS points). Normal small artery elasticity values were 3 ml/mmHg or higher (0 RDS points), borderline values were 2.5-2.9 ml/mmHg x100 (1 RDS point), and abnormal values were under 2.5 ml/mmHg x 100 (2 RDS points).

### **Measuring Physical Activity**

The International Physical Activity Questionnaire (IPAQ) was used to operationalize the concept of physical activity (Craig, et al., 2003). This self-report questionnaire measures the amount of vigorous, moderate, walking and sitting activity completed by an individual over a 7-day period. Physical activity has been shown to reduce the risk for CVD through reducing blood pressure, contributing to weight loss, decreasing LDL cholesterol levels, and improving insulin use (LaVie et al., 2015). In an international validation study across 12 countries, the IPAQ demonstrated strong test-retest reliability with an average Spearman's correlation of 0.8 (Craig et al., 2003). Additionally, this study found that the IPAQ had acceptable criterion validity with a median inter-rater method coefficient of 0.3.

This questionnaire is made up of seven items asking participants to list the amount and intensity of physical activity they have engaged in over the last seven days. Questions 1 and 2

ask about vigorous physical activity (examples are given) in the last seven days; how many days out of seven, and the average length of time spent on activity each day. Questions 3 and 4 ask for the number of days, and average length of time per day of moderate activity. The description of moderate activity is “activities that take moderate physical effort and make you breathe somewhat harder than normal.” Questions 5 and 6 ask about the number of day a participant walked for at least 10 minutes and on average how much time they spent walking each time. Question 7 is an estimation of the amount of time (minutes or hours) a participant spent sitting in the last 7 days. High level of physical activity on the IPAQ is classified as: 3 or more days of vigorous activity of at least 20 minutes per day, or 7 or more days of moderate-intensity activity and/or walking at least 30 minutes per day. A moderate amount of physical activity is classified as: at least 5 days of moderate intensity activity and/or walking of at least 30 minutes per day, or 3 or more days of vigorous-intensity activity of at least 20 minutes per day. Individuals who do not meet the above criteria are considered to have low levels of physical activity. The last question regarding sitting time is an indication of time spent in sedentary activity. A Flesch-Kincaid analysis of the readability of this tool indicated a reading level of grade 8.6 (Schembre, Durand, Blissmer, & Green, 2015) which was appropriate considering the average educational level of the current sample.

### **Measuring Fitness**

The Six-Minute Walk Test (6MWT: see Appendix E) was used as a one-time measurement of physical fitness. This test is a simple and practical, only requiring participants to walk on a flat surface for six minutes. The 6MWT has been shown to correlate with physical fitness as assessed by a maximal graded exercise test (Crapo et al., 2002). Based on a systematic review by Bellet, Adams, and Morris (2012) this test has been shown to be a reliable measure to

assess for clinical change in fitness after participating in an CR. Fitness is a variable of interest for the same reasons as physical activity; it has been shown to decrease the risk for heart disease through blood pressure reduction, weight loss, improved cholesterol levels, and enhancing the body's use of insulin (Myer et al., 2015). In a sample of patients with CVD, those individuals who could walk 450 meters had an almost 3-fold decrease in their risk of death when compared with patients who could only walk less than 300 meters (Bittner & et al., 1993).

Multiple studies have compared the measurement of physical fitness using the 6MWT with a maximal graded exercise test and found an average  $r=0.82$ , supporting the validity of this test (Ross, Murthy, Wollak, & Jackson, 2010). When the 6-minute walk test was used to assess CRP participants on 2 separate occasions, strong test-retest reliability was demonstrated with a correlation coefficient of  $r=0.97$  (Bellet, Adams, & Morris, 2012). In a sample of health men and women between the ages of 55 and 75, the average 6MWT distance was 631 m for female participants and bivariate analysis revealed a significant correlation with lung capacity, which is another indication of physical fitness (Camarri, Eastwood, Cecins, Thompson, & Jenkins, 2006). This tool has been used in female samples and found to have acceptable reliability  $r=0.92$  (Avergaard, Larsen, Holtze, Ockholm, & Kristensen, 2017).

In the HHS, the 6MWT was carried out according to the guidelines set out by the American Thoracic Society (Crapo et al., 2002). Participants walked the length of a corridor, back and forth between two markers set sixty meters apart. Before the test, the women were instructed to complete as much distance as possible during the timed 6-minute interval. Additionally, they were informed that they could rest at any time if needed. The research assistant used a stopwatch to count the six minutes and recorded completed laps. No encouragement was provided for the participants, but they were notified of the time in one

minute intervals. The portion of the final lap completed was measured using a counter distance measuring wheel. The total completed laps were added to the partially completed final lap to achieve the total distance covered in meters.

**Measuring Outcome Expectations.** The Outcome Expectations Questionnaire (OEQ; Blanchard, 2003; see Appendix F) was used to assess participants' perceptions of the potential outcomes of being physically active. This tool was initially developed by Blanchard and colleagues (2003) in their work with CRP participants. This instrument has been shown to be reliable with a Cronbach's alpha of 0.87 (Blanchard et al., 2003). Validity was established through significant correlations with attitude towards physical activity ( $r=0.43$ ) and intention to be active ( $r=0.28$ ). Importantly, further testing of the OEQ has also been undertaken in research involving women at risk for CVD with similar results (Blanchard, Arthur, & Gunn, 2015; Blanchard et al., 2007, Blanchard et al., 2011).

The OEQ includes seven items delivered in a Likert scale format. Participants are asked to respond to the statement: "During the next 6 months, if I adhere to an exercise routine on a weekly basis, it will definitely..." Responses are marked by checking the box under one of the following options: strongly disagree, disagree somewhat, neither agree or disagree, agree somewhat, strongly agree. Each item is given a score (i.e. strongly disagree=1 to strongly agree=5) and the items are added to achieve a total score between 7 and 35. The authors do not provide a scale to define what constitutes high and low outcome expectancies, so the scores were assessed on a continuum. Readability was not found to have been assessed on this scale; however, the entire scale has only 3 words with 3 or more syllables and therefore, according to SMOG criteria this tool would be at a grade 5 reading level (McLaughlin, 1969).

**Measuring demographic and personal factors.** As part of the HHS, three demographic characteristics were collected: age, height, and weight (see Demographic Questionnaire, Appendix A). Age was self-reported by date of birth. Height (in cm) and weight (in kg) were measured by the study research assistant, using the same scale for each participant. These measurements were used to calculate a body mass index.

**Measuring frailty.** The Modified Fried Criteria phenotype was used to assess the variable of frailty in this population (Fried et al., 2001). This tool has been used extensively to assess frailty in elderly populations; a systematic review of 264 articles which featured the Fried phenotype, reported internal consistency values (i.e., Cronbach's alpha) between 0.599 to 0.645.

The Fried score classifies participants as frailty if three or more of the following criteria were met: (1) unintentional weight loss, (2) self-reported exhaustion, (3) weakness, (4) slow walking speed and (5) low physical activity. A patient was considered pre-frail if 1 or 2 of the preceding criteria were met.

Exhaustion was assessed by the Center for Epidemiologic Studies- Depression Scale (Radloss, 1977). Physical activity was assessed using the Paffenbarger Physical Activity Scale (Nowak, Plew, Skowrong, & Paffenbarger, 2010). Unintentional weight loss was determined using a questionnaire, and the weakness and slow walking speed were assessed using a grip strength dynamometer (Leon & Teo, 2015), and a 5 m gait speed test (Affialo, et al., 2014).

### **Data Collection Procedures**

In the HHHPP study, data collection occurred at baseline and post-intervention (i.e., 12 weeks); for the purpose of this thesis project only baseline data were considered. The baseline data was collected during a 90-minute appointment during which the participant completed the

questionnaires, followed by the physical measures including the adapted Rasmussen disease score, and the 6MWT.

### **Data Analysis Plan**

Statistical analyses were done with the assistance of the MCHNR staff and in close collaboration with the statistician for the Cardiac Sciences Program at the St. Boniface Hospital. Descriptive statistics (percentages, mean, median, standard deviation) were applied to the demographic factors. Bivariate and multivariate regression analyses were performed to address each of the research questions.

Parametric tests are appropriate for use when dealing with data that are normally distributed (Polit & Beck, 2012). Parametric tests were used to test for possible association between the continuous variables in the study; specifically, the Pearson R correlation coefficient was calculated. Non-parametric tests do not assume that the data follows a normal distribution and are appropriate for use with ordinal data (Polit & Beck, 2012). The Spearman's rho correlation coefficient was used to test association between categorical variables in this study. Regression analysis is used to model the relationship between an outcome variables and multiple predictor variables (Polit & Beck, 2012). The aim of this type of analysis is to determine whether any of the variation in the outcome variable can be explained by one or more of the predictor variables, and to quantify the magnitude of this influence. The level of significant chosen for all analyses was alpha 0.05.

### **Ethical Considerations**

The HHS was approved by two ethics review panels: the University of Manitoba Health Research Ethics Board (HREB), and the St. Boniface Hospital Clinical Research Committee. The study was explained to each participant and the risks were outlined prior to obtaining

informed consent. Participants were given the option of receiving a summary of their individual study results and/or a summary of the study as a whole upon completion of the study. The risk associated with this study was due to the participant's engagement in a moderate level of physical activity, and is similar to the risk experienced daily when participating in any type of physical activity. This risk was considered minimal and was discussed with the participants prior to obtaining informed consent. There was no deception in this study. Confidentiality was maintained throughout study; data were coded with numerical references and the spreadsheet with participant's names was kept in a locked filing cabinet. All HHHPP research staff signed the Personal Health Information Act (PHIA) pledge. No incentives or compensation were offered to participants in the HHHPP study.

### **Summary**

In summary, this thesis study used a retrospective, cross-sectional design to explore the relationship between self-efficacy, physical activity, and CVD risk. Measurement tools for self-efficacy, physical activity, physical fitness, outcome expectation, and demographic/personal factors were carefully chosen to operationalize these key study concepts. Ethical considerations were addressed in planning the larger study and were maintained throughout the thesis study. The plan for data analysis was established in consultation with a statistician. Thus, this thesis study has sound methodology for addressing the key study question.

## CHAPTER FIVE: RESULTS

This chapter presents the findings of the thesis research, which was based on data from the HHHPP study. The findings discussed pertain to the study purpose to explore the relationship between women's risk for CVD and self-efficacy beliefs. Specifically, the following research questions are discussed:

1. What is the relationship between actual CVD risk and self-efficacy in women at moderate to high risk for CVD?
2. What is the relationship between individual characteristics (i.e., age, BMI, living alone, post-secondary, education, frailty), past experiences (i.e., physical activity, physical fitness) and self-efficacy beliefs in women at moderate-high risk for CVD?
3. What is the relationship between self-efficacy for exercise and general self-efficacy in relation to the behavior of physical activity?
4. What is the relationship between self-efficacy and outcome expectations in women at risk for CVD?

### Data Collection and Analysis

Baseline data for this study were collected over a 6-month period from December 1, 2016 until June 1, 2017. Data were cleaned and entered into a database by the HHHPP research staff. Statistical Package for the Social Sciences (SPSS) was utilized for the data analysis. Statistical support for the data analysis in the current thesis project was provided by the St. Boniface Hospital Cardiac Sciences Program statistician, and by the MCNHR research coordinator.

### Description of Sample

#### Individual Characteristics and Experiences

Tables 1 and 2 provide a summary of the descriptive statistics for the continuous and categorical variables related to individual characteristics and experiences. As outlined in Table 1, the women who participated in this study were between the ages of 57 and 83, with an average

age of 68 years. The distribution between age groups is summarized in Table 2, and identifies that the majority (79.2%) of the participants were in the middle age groups of 60-74 years.

**Table 1**

*Descriptive Statistics: Continuous Variables of Individual Characteristics*

Characteristics	Minimum	Maximum	Mean	SD
Age	57	83	67.61	5.74
Rasmussen Disease Score	0	8	4.26	2.18
Frailty (continuous)	0	3	0.35	0.63
BMI (kg/m <sup>2</sup> )	18.0	44.6	27.50	5.22

SD= standard deviation; BMI=body mass index

The average Rasmussen Disease Score (RDS) of the women in this sample is 4.26 (see Table 1), indicating that they are all at moderate to high risk for CVD. Furthermore, RDS scores were found to increase along with age; in other words, the oldest women were found to be at highest risk for CVD (see Table 3). Table 2 also provides a summary of the education levels of the women in the sample and whether or not they lived alone at the time of the study. All of the women reported having a minimum of high school education while the majority (61.2%) had post-secondary education. A third of the women lived alone, while the other two-thirds lived with a spouse, partner, or relative.

**Table 2***Descriptive Statistics: Categorical Variables of Individual Characteristics*

Characteristic	n	(%)
<b>Age by Category (years)</b>		
55-59	8	(5.8)
60-64	32	(27.5)
65-69	38	(31.7)
70-74	24	(20.0)
75-79	15	(12.5)
80-84	3	(2.5)
<b>Frailty Score*</b>		
0	85	(71.4)
1	26	(21.8)
2	7	(5.8)
3	1	(0.8)
<b>Education</b>		
High School	27	(22.3)
Post-Secondary Education	93	(77.5)
<b>Living Alone</b>		
Lives alone	38	(31.7)
Lives with Spouse, Partner, or Relative	81	(67.5)

\*0= Not Frail 1 or 2= Pre Frail 3= Frail

**Table 3***Distribution of Rasmussen Disease Score by Age Category*

Age Category	Minimum	Maximum	Mean	SD
55-59	1	6	2.375	1.77
60-64	0	8	3.87	2.29
65-69	0	8	3.68	1.86
70-74	2	8	5.04	1.90
75-79	3	8	5.87	1.85
80-85	4	8	6.33	2.08

The average frailty score of the study participants was 0.35 out of 5, with the maximum score being only a 3 (see Table 1). Only one woman was assessed as “frail”; 31 women met the criteria for “pre-frail”, and 87 were found to be “not frail” (see Table 4). The single participant who classified as “frail” was in the age group between 60-64 years. The majority of the “pre-frail” participants were in the age groups between 60-74 years. Frailty trends can be seen in Figure 6, which depicts the ratio of “not-frail” to “frail.” Although the number of “pre-frail” women was similar between the age groups of 60-64, 65-69, and 70-74, the ratio of “pre-frail” to “not-frail” is much higher in the oldest age group (70-74 years).

**Table 4**

*Distribution of Frailty Scores by Age Categories*

Age	Not Frail		Pre-Frail		Frail	
	n	(%)	n	(%)	n	(%)
55-59 years	7	(5.8)	1	(0.8)	0	(0)
60-64 years	21	(19.2)	10	(7.5)	1	(0.8)
65-69 years	28	(24.7)	10	(8.3)	0	(0)
70-74 years	16	(13.3)	8	(6.7)	0	(0)
75-79 years	12	(10.8)	3	(2.5)	0	(0)
80-85 years	2	(1.7)	1	(0.8)	0	(0)
n total	86		33		1	

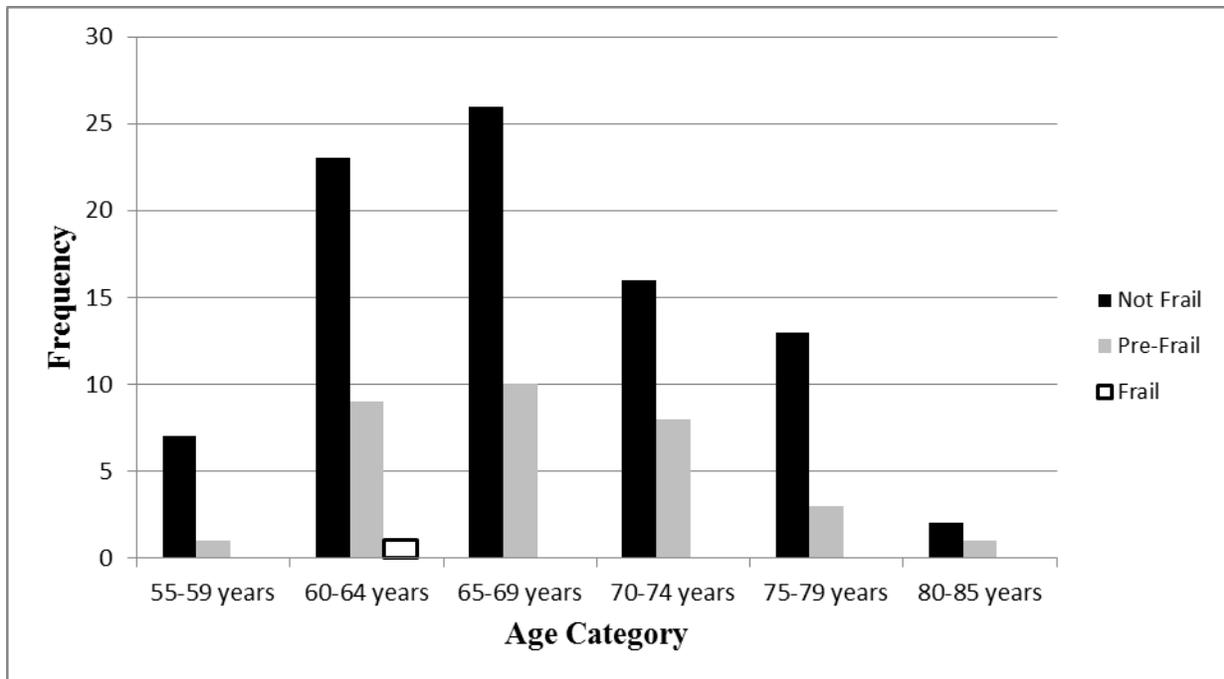


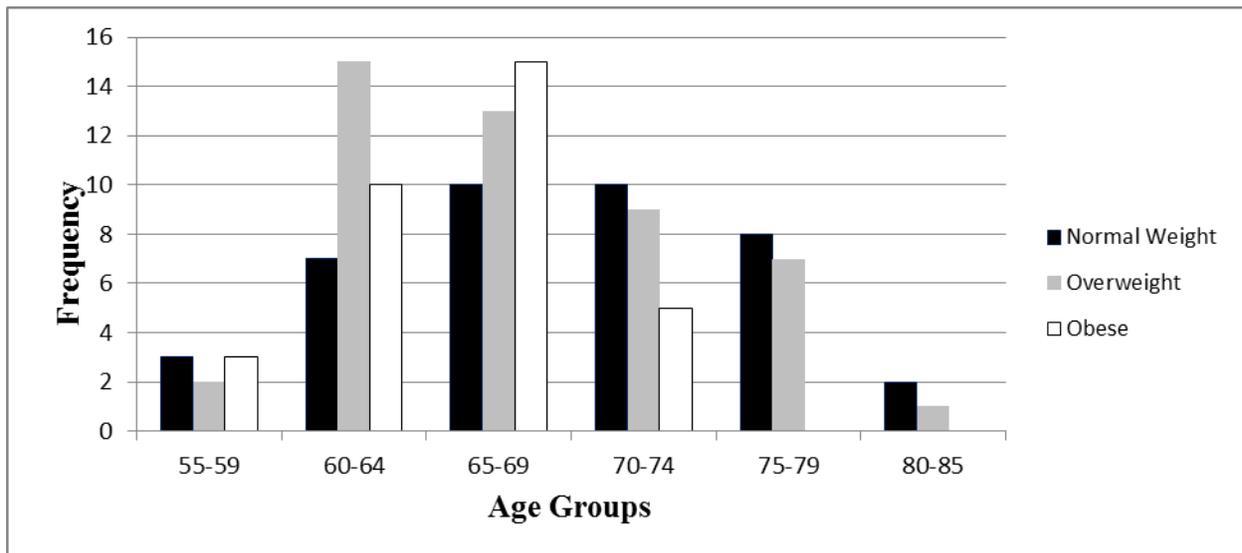
Figure 6 Distribution of Frailty Phenotypes by Age Group

The women in this study sample were of varying body compositions, as evidenced by the broad range of BMI measurements between 18 and 46 kg/m<sup>2</sup> (see Table 1). The mean BMI of the sample was 27.5 kg/m<sup>2</sup> (see Table 1), indicating that, on average, the participants were within an overweight range (i.e., BMI of 25-30 kg/m<sup>2</sup>; Government of Canada, 2011). A further breakdown of the participants' BMIs according to age group, revealed that this variable was normally distributed (see Table 5 and Fig. 7). The 60-64 year old age group had the highest percentage of participants with BMIs in the overweight range (46.9%) and the 65-69 year old group had the highest percentage of participants with BMIs in the obese range (39.5%). These two age groups had the most participants (32 and 38 respectively). The oldest age group (80-85 years of age) had the fewest participants (n=3) and the highest percentage with a normal BMI (66.6%). There were no participants in the oldest age group with a BMI in the obese range (i.e., BMI greater than 30; Government of Canada, 2011).

**Table 5**

*Distribution of Body Mass Index by Age Category*

Characteristic	Normal Weight (19-24 kg/m <sup>2</sup> )		Overweight (25-39 kg/m <sup>2</sup> )		Obese (>30 kg/m <sup>2</sup> )	
	n	(%)	n	(%)	n	(%)
Age Category						
55-59	3	(2.5)	2	(1.7)	3	(2.5)
60-64	7	(5.8)	15	(12.5)	10	(8.3)
65-69	10	(8.3)	13	(10.8)	15	(12.5)
70-74	10	(8.3)	9	(7.8)	5	(4.2)
75-79	8	(6.6)	7	(5.8)	0	(0)
80-85	2	(1.7)	1	(0.8)	0	(0)



*Figure 7 Weight Range According to BMI Distributed by Age Groups*

The trends between the variables of BMI and frailty are compared in Figure 8. The group of women between the ages of 65-69 had the highest percentage of obesity (39.5%), while both of the older age groups (75-79 years and 80-85 years) had no participants in the obese category. The highest numbers of pre-frail women (ages 60-69), coincides with that the highest numbers of overweight (ages 60-64) and obese women (ages 65-69). There was a downward trend in the number of overweight women after the ages of 60-64 years. The number of obese women also trends down after the ages of 65-69. The number of pre-frail women peaks in the 65-69 year category and then diminishes with each with each increase in age. This trend was mirrored in the frequency of women in the normal weight category, which plateaus between the ages of 65-74, and then declines with each subsequent increase in age.

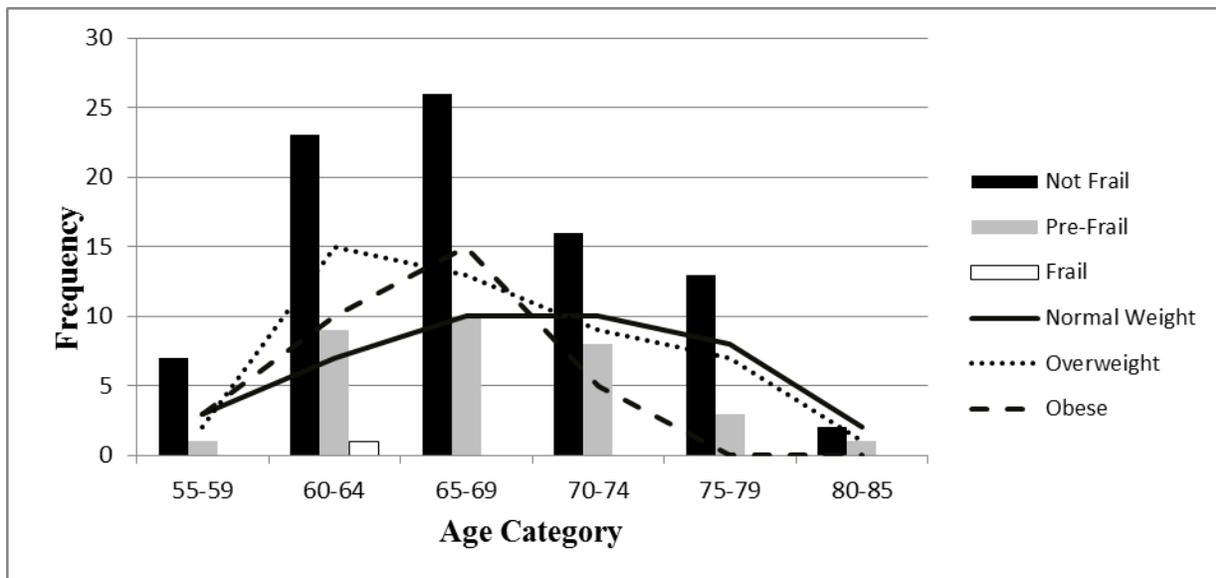


Figure 8 Distribution of Frailty Categories vs Weight Categories According to Age Groups

The descriptive statistics of physical activity levels of the study participants are highlighted in Table 6. In the self-reported estimate of their average physical activity, these women reported performing 107 minutes of vigorous physical activity, 264 minutes of walking, and 240 minutes of moderate to vigorous physical activity per week. When examined by age group (see Table 6), a large percentage of women reported that they performed no vigorous or moderate physical activity in the past week (see Minimum frequency column in Table 6). The women between the ages of 75-79 years reported the highest amount of vigorous activity with an average of 164.53 minutes/week; however, there were only 15 women in this age category. The 60-64 year-old women reportedly engaged in the most moderate to vigorous physical activity (MVPA), with an average of 293.28 minutes/week. The most minutes of weekly walking was reported by the women aged 75-79 years. The women over the age of 80, reported the lowest average amount of vigorous physical activity, MVPA, and walking. The lowest average weekly amount of moderate weekly physical activity was reported by the youngest group of women (age 55-59). On average the women in this sample were able to walk 557 meters in the 6-minute walk test, with a distance ranging between 270 meters and 754 meters (see Table 7). The average distance walked in the 6-minute walk test decreased with age: the youngest group walked an average distance of 597 meters and the oldest group walked an average of 449 meters.

**Table 6**

<i>Distribution of Self-Reported Physical Activity by Age Groups</i>					
	Minimum	(n)/%	Maximum	Mean	SD
Total Vigorous PA min/wk	0		1080	107.29	169.58
55-59	0	(3)/38%	380	124	150.29
60-64	0	(18)/56%	1080	113.9	232.56
65-69	0	(17)/45%	360	87.4	127.95
70-74	0	(11)/46%	630	119.59	127.08
75-79	0	(3)/20%	630	164.53	209.65
80-85	0	(1)/33%	150	83.33	76.38
Total Moderate min/wk	0		1440	133.35	195.66
55-59	0	(3)/43%	270	93.75	96.8
60-64	0	(13)/39%	1440	179.38	294.5
65-69	0	(12)/32%	630	121.63	156.19
70-74	0	(10)/42%	630	142.65	91.67
75-79	0	(6)/40%	720	172.67	188.78
80-85	0	(1)/33%	250	103.33	130.51
Total MVPA min/wk	0		1540	240.62	291.61
55-59	0	(3)/38%	570	217.88	227.99
60-64	0	(8)/25%	1440	293.28	397.27
65-69	0	(9)/24%	1050	209.08	239.9
70-74	0	(5)/21%	520	174.41	158.53
75-79	0	(2)/13%	1350	384	349.42
80-85	0	(1)/33%	350	186.67	176.16
Total Walking min/wk	0		1680	264.47	296.66
55-59	0	(1)/13%	450	260.12	195.54
60-64	0	(4)/13%	1680	304	360.71
65-69	0	(2)/5%	840	288.81	250.60
70-74	0	(6)/25%	840	146.25	173.75
75-79	0	(2)/13%	1260	379.75	433.03
80-85	105	(1)/33%	210	145	56.79

PA= physical activity; MVPA= moderate to vigorous physical activity

**Table 7**

<i>Distribution of 6 Minute Walk Test Results (Meters) by Age Group</i>				
	Minimum	Maximum	Mean	SD
Age in years	270	754	557.21	72.42
55-59	531	754	597	70.78
60-64	470	690	572.25	56.65
65-69	450	720	567.45	53.81
70-74	300	730	563.1	84.05
75-79	270	660	525.46	99.37
80-85	393	480	449	39.67

The average general self-efficacy score reported by women in this sample was 32.22 out of 40 (see Table 8). The mean general self-efficacy scores were similar across all age groups. The average MDSE score for the entire sample was 68.81 out of a maximum score of 90. The MDSE sub-scores were also similar across age groups, with the exception of the scores in the oldest age category (age 80-85), which were noticeable lower than any of the other groups. Both the minimum and maximum scores in every subscale were significantly lower in the oldest age category (age 80-85). The sub-scale of MDSE (barrier) had the lowest scores of any of the sub-scales with an average score of 19.5 out of 30, and this trend was similar across each age category. According to the MDSE measure, lower barrier scores indicate fewer barriers to engaging in PA.

**Table 8***Distribution of Self-Efficacy Scores by Age Group*

Characteristics	Minimum	Maximum	Mean	SD
General SE	14	40	32.22	4.16
55-59	28	32	29.63	1.69
60-64	25	39	33.13	3.94
65-69	21	40	32.16	4.29
70-74	21	40	32.15	4.29
75-79	14	39	32.28	4.61
80-85	29	30	29.67	0.58
MDSE (total)	7	90	68.81	13.62
55-59	59	78	69.88	6.83
60-64	42	86	68.88	11.47
65-69	43	90	68.71	11.08
70-74	47	82	69.57	10.34
75-79	37	84	71.88	12.14
80-85	7	65	44.33	32.39
MDSE (task)	3	30	24.28	4.63
55-59	20	28	24	3.07
60-64	16	30	24.39	3.55
65-69	17	30	24.39	3.55
70-74	14	30	24.34	4.03
75-79	14	30	25.19	3.67
80-85	3	20	14	9.53
MDSE (barrier)	0	30	19.50	5.6
55-59	15	24	19.25	3.28
60-64	9	29	19.84	5.65
65-69	9	30	19.68	3.34
70-74	10	26	19.26	4.47
75-79	10	27	20.5	5.39
80-85	0	17	11.33	9.81
MDSE (scheduling)	4	30	25.00	5.53
55-59	22	30	26.63	2.87
60-64	9	30	24.34	5.13
65-69	15	30	24.63	4.73
70-74	16	30	25.96	4.21
75-79	9	30	26.19	5.23
80-85	4	29	19	13.23

SE=self-efficacy; MDSE=multidimensional exercise self-efficacy

## Analysis of Research Questions

The following is a summary of the statistical analysis for each of the four research questions.

**Research Question #1.** *What is the relationship between actual CVD risk and self-efficacy in women at moderate to high risk for CVD?*

This research question was initially addressed through a bivariate, correlational analysis (Pearson's  $r$  & Spearman's  $\rho$ ) of the variables of interest, to determine if there were significant correlations between cardiac risk (i.e., RDS scores) and the five types of self-efficacy beliefs (General SE, MDSE [Total, Task, Barrier, and Scheduling]; see Table 9). These initial analyses did not reveal any significant correlation between these variables. This question was further explored using linear regression models to test the relationships between the outcomes of self-efficacy (General SE, MDSE [Total, Task, Barrier, and Scheduling]) and a linear combination of potentially predictive variables (i.e., personal characteristics, measures of physical activity, RDS score; see Tables 10-14).

A bivariate analysis was initially performed to determine the relationship between each of these potentially predictive variables and the five outcomes of interest. A final multivariate model was developed for each outcome using a stepwise selection method with a  $p$  value cutoff of less than 0.10 being used for entry and exit from the model. Only factors with a  $p$ -value of 0.20 or less in the bivariate analysis were considered as potential covariates in the stepwise selection. In this final model the variable of cardiac risk (RDS) did not significantly contribute to any of the measures of self-efficacy. In summary, no association was established between the outcome of self-efficacy and the predictive variable of cardiac risk.

**Table 9**

*Study Variables: Correlation Analysis*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Age	1	-.269**	-0.40	.421**	-.058	.034	-.028	.001	-.264**	.090	-.070	-.132	.000	-.040
2. BMI		1	.315**	-.159	-.136	-.058	.135	.057	-.364**	.100	-.059	-.027	-.049	-.068
3. Frailty			1	.080	-.201*	-.061	-.076	-.087	-.237*	-.116	-.265*	-.241*	-.166	-.261*
4. RDS				1	-.171	.072	-.111	-.033	-.170	.116	-.023	-.013	.029	-.070
5. Walking (min/wk)					1	.191*	.114	.188*	.081	.122	.085	.112	.121	-.007
6. Vig PA (min/wk)						1	.271**	.764**	.020	.088	-.022	-.058	-.082	.071
7. Mod PA (min/wk)							1	.829**	.116	.257**	.040	.016	-.008	.087
8. MVPA (min/wk)								1	.089	.224*	.014	-.023	-.053	.100
9. 6MWT (meters)									1	-.029	.190*	.277**	.078	.145
10. General SE										1	.204*	.298**	.139	.103
11. MDSE (total)											1	.826**	.851**	.834**
12. MDSE (task)												1	.615**	.530**
13. MDSE (schedule)													1	.517**
14. MDSE (barrier)														1

\*P Value<0.05 \*\*P Value<0.01 Pearson R was calculated for continuous variables and Spearman's Rho was calculated for categorical variables

BMI=body mass index; RDS=Rasmussen Disease Score; Vig PA= vigorous physical activity; mod PA= moderate physical activity; MVPA=moderate to vigorous physical activity; 6MWT=six-minute walk test; General SE= general self-efficacy; MDSE= multidimensional self-efficacy;

**Table 10***Factors Associated with General Self-Efficacy: Regression analysis (Initial Model)*

Variable	$\beta$	SE	P-value	R-square
Age	0.066	.067	0.329	0.8%
BMI	0.08	0.074	0.278	1.0%
RDS	0.222	0.176	0.211	1.3%
Pre-Frail/Frail vs Not Frail	-1.118	0.851	0.191	1.5%
Fried Frailty (Continuous)	-0.759	0.609	0.215	1.3%
Outcome Expectations	0.026	0.061	0.668	0.2%
Total Vigorous PA min/wk	0.002	0.002	0.338	0.8%
Total Mod PA min/wk	0.006	0.002	0.005*	6.6%
Total MVPA min/wk	0.003	0.001	0.014*	5.0%
Total Walking min/wk	0.002	0.001	0.184	1.5%
Total PA min/wk	0.002	0.001	0.014*	5.0%
6MWT in meters	-0.002	0.006	0.753	0.1%

*Factors Associated with General Self-Efficacy: Regression analysis (Final Model)*

Variable	$\beta$	SE	P-value	R-square
Total Mod PA min/wk	0.006	0.002	0.005*	6.6%

\*P-Value&lt;0.10

BMI=body mass index; RDS=Rasmussen Disease Score; Mod PA= moderate physical activity, MVPA=moderate to vigorous physical activity; PA=physical activity; 6MWT=six minute walk test

**Table 11***Factors Associated with Multidimensional Total Self-Efficacy: Regression Analysis (Initial Model)*

Variable	$\beta$	SE	P-value	R-square
Age	-0.147	.194	0.450	0.8%
BMI	-0.138	0.214	0.520	0.3%
RDS	-0.128	0.522	0.806	0.1%
Pre-Frail/Frail vs Not Frail	-6.659	2.407	0.007*	6.1%
Frailty (Continuous)	-5.5068	1.715	0.004*	6.9%
Outcome Expectations	0.041	0.178	0.819	0.0%
Total Vigorous min/wk	-0.002	0.007	0.809	0.0%
Total Moderate min/wk	0.003	0.006	0.661	0.2%
Total Walking min/wk	0.003	0.004	0.355	0.7%
Total MVPA/wk	0.001	0.004	0.878	0.0%
Total PA min/wk	0.002	0.002	0.482	0.4%
6MWT	2.343	0.006	0.753	0.1%

*Factors Associated with Multidimensional Self-Efficacy: Regression Analysis (Final Model)*

Variable	$\beta$	SE	P-value	R-square
Fried Frailty (Continuous)	-5.5068	1.715	0.004*	6.9%

\*P-Value&lt;0.10

BMI=body mass index; RDS=Rasmussen Disease Score; Mod PA= moderate physical activity, MVPA=moderate to vigorous physical activity; PA=physical activity; 6MWT=six minute walk test

**Table 12***Factors Associated with Multidimensional Task Self-Efficacy: Regression Analysis (Initial Model)*

Variable	$\beta$	SE	P-value	R-square
Age	-0.094	0.065	0.151	1.7%
BMI	-0.021	0.072	0.767	0.1%
RDS	-0.024	0.175	0.890	0.0%
Pre-Frail/Frail vs Not Frail	-2.076	0.815	0.012*	5.3%
Frailty (Continuous)	-1.558	0.581	0.008*	5.8%
Outcome Expectations	0.032	0.060	0.590	0.2%
Total Moderate min/wk	0.000	0.002	0.863	0.0%
Total MVPA/wk	0.000	0.001	0.804	0.1%
Total PA min/wk	0.001	0.001	0.524	0.3%
6MWT	0.018	0.006	0.002*	7.7%

*Factors Associated with Multidimensional Task Self-Efficacy: Regression Analysis (Final Model)*

Variable	$\beta$	SE	P-value	R-square
Fried Frailty (Continuous)	-1.191	0.585	0.044	11.0%
6MWT	0.015	0.006	0.011	

\*P-Value&lt;0.10

MDSE= multidimensional exercise self-efficacy; BMI=body mass index; RDS=Rasmussen Disease Score; Mod PA= moderate physical activity, MVPA=moderate to vigorous physical activity; PA=physical activity; 6MWT=six minute walk test

**Table 13**

Factors Associated with Multidimensional Barrier Self-Efficacy: Regression Analysis (Initial Model)

Variable	$\beta$	SE	P-value	R-square
Age	-0.054	0.086	0.532	0.3%
BMI	-0.069	0.094	0.463	0.5%
RDS	-0.172	0.229	0.454	0.5%
Pre-Frail/Frail vs Not Frail	-2.682	1.068	0.013*	5.1%
Frailty (Continuous)	-2.206	0.757	0.004*	6.8%
Outcome Expectations	-0.034	0.078	0.667	0.2%
Total Vigorous min/wk	0.002	0.003	0.439	0.5%
Total Moderate min/wk	0.002	0.003	0.439	0.5%
Total Walking min/wk	0.000	0.002	0.938	0.0%
Total MVPA/wk	0.002	0.003	0.344	0.8%
Total PA min/wk	0.002	0.002	0.278	1.0%
6MWT	0.012	0.008	0.113	2.1%

Factors Associated with Multidimensional Barrier Self-Efficacy: Regression Analysis (Final Model)

Variable	$\beta$	SE	P-value	R-square
Fried Frailty (Continuous)	-2.206	0.757	0.004	6.8%

\*P-Value&lt;0.10

BMI=body mass index; RDS=Rasmussen Disease Score; Mod PA= moderate physical activity, MVPA=moderate to vigorous physical activity; PA=physical activity; 6MWT=six minute walk test

**Table 14***Factors Associated with Multidimensional Scheduling Self-Efficacy: Regression Analysis (Initial Model)*

Variable	$\beta$	SE	P-value	R-square
Age	0.000	0.081	0.997	0.0%
BMI	-0.047	0.089	0.597	0.2%
RDS	0.068	0.217	0.752	0.1%
Pre-Frail/Frail vs Not Frail	-1.900	1.018	0.064*	2.9%
Frailty (Continuous)	-1.305	0.729	0.076*	2.7%
Outcome Expectations	0.042	0.074	0.570	0.3%
Total Vigorous min/wk	-0.002	0.003	0.370	0.7%
Total Moderate min/wk	0.000	0.002	0.931	0.0%
Total Walking min/wk	0.002	0.002	0.187	1.5%
Total MVPA/wk	-0.001	0.002	0.563	0.3%
Total PA min/wk	0.001	0.001	0.626	0.2%
6MWT	0.006	0.007	0.399	0.6%

*Factors Associated with Multidimensional Scheduling Self-Efficacy: Regression Analysis (Final Model)*

Variable	$\beta$	SE	P-value	R-square
Fried Pre-Frail/Frail vs Not Frail	-1.900	1.018	0.064*	2.9%

\*P-Value&lt;0.10

MDSE=multidimensional exercise self-efficacy; BMI=body mass index; RDS=Rasmussen Disease Score; Mod PA=moderate physical activity, MVPA=moderate to vigorous physical activity; 6MWT=six minute walk test

**Research Question #2.** *What is the relationship between individual characteristics (i.e., age, BMI, frailty), past experiences (i.e., physical activity, physical fitness), and self-efficacy for exercise in women at moderate-high risk of CVD?*

This research question was initially addressed through a bivariate, correlational analysis (Pearson's  $r$  & Spearman's  $\rho$ ; see Table 9) of the demographic factors and the self-efficacy beliefs to determine if there were significant correlations between these variables of interest. The initial analyses revealed several significant correlations: General self-efficacy was positively correlated with moderate physical activity (min/wk), and MVPA (min/wk). MDSE (total) and MDSE (task) was negatively correlated with frailty, and positively correlated with the 6MWT. MDSE (barrier) was negatively correlated with the variable of frailty.

These associations were further explored through a linear regression analysis of the variables with all five types of self-efficacy as the outcomes (see Table 10-14). Initially, a bivariate analysis was performed to determine the relationship between each of these potentially predictive variables and the five outcomes of interest. In these analyses, the variables of Total Moderate Physical Activity, Total MVPA/wk, and Total Physical Activity min/wk significantly contributed to the outcome of General Self-Efficacy. A final multivariable model was developed for each outcome using a stepwise selection method with a  $p$  value cutoff of less than 0.10 being used for entry and exit from the model. Only factors with a  $p$ -value of  $<0.20$  in the bivariate analyses were considered as potential covariates in the stepwise selection. The final regression models identified at least one significantly predictive variable for each type of self-efficacy. The variable of Total Moderate Physical Activity was a significant predictor of the outcome of General self-efficacy ( $\beta=0.006$ ;  $R^2$  6.6%; see Table 10). Frailty was identified as a significant predictor of the outcome of total MDSE ( $\beta= -5.5068$ ;  $R^2= 6.9\%$ ; see Table 11). The variables of

frailty (continuous) and the 6MWT were found to be significant predictors of the outcome of task MDSE ( $\beta = -1.191/0.015$ ;  $R^2 = 11\%$ ; see Table 12). The variable of frailty (continuous) was found to be a significant predictor of the outcome of barrier MDSE ( $\beta = -2.206$ ;  $R^2 = 6.8\%$ ; see Table 13). Frailty (Pre-Frail/Frail vs Not Frail) was found to be a significant predictor of the outcome of MDSE for scheduling ( $\beta = -1.900$ ;  $R^2 = 2.9\%$ ; see Table 14).

In summary, the major findings of the initial bivariate analysis revealed that General SE was correlated with two types of self-reported physical activity (moderate and MVPA), while MDSE (total and task) were negatively correlated with frailty and positively correlated with the 6MWT. MDSE (barrier) also showed significant negative correlation with the variable of frailty. The regression analysis revealed that the variable of frailty was a significant predictor of the outcomes of MDSE (i.e., total, barrier, schedule). The outcome of MDSE (task) was significantly predicted by the variables of frailty and the 6MWT. Finally, the outcome of General SE was significantly predicted by the variable of Moderate Physical Activity (min/wk).

**Research Question #3** *What is the relationship between self-efficacy for exercise and general self-efficacy in relation to the behavior of physical activity?*

This research question was initially addressed through a bivariate, correlational analysis (Pearson's  $r$ ; see Table 9) of the five types of self-efficacy to determine if there were significant correlations between these variables of interest. General SE was shown to be positively correlated to MDSE (total, task). MDSE (total) was positively correlated with General SE and all three subtypes of MDSE (task, schedule, barrier). In summary, positive correlations were found between the variables of General SE and two types of MDSE (total, task). The relationship between self-efficacy and physical activity was addressed under Research Question #2.

**Research Question #4** *What is the relationship between self-efficacy and outcome expectations in women at risk for CVD?*

This research question was initially addressed through a bivariate, correlational analysis (Pearson's  $r$ ; see Table 9) between the five types of self-efficacy and outcome expectations to determine if there were significant correlations between these variables of interest. No significant correlations were found between outcome expectation and any of the five types of self-efficacy. This relationship was further investigated through regression analysis using the five types of self-efficacy as the outcome of interest. In the initial models of each of these analyses, outcome expectations did not significantly contribute to the outcome of self-efficacy (see Table 15). In summary, no association was identified between the variables of Self-Efficacy and Outcome Expectations.

**Table 15***Factors Associated with Outcome Expectations: Regression Analysis (Initial Model)*

Variable	$\beta$	SE	P-value	R-square
Age	-0.030	0.101	0.764	0.1%
BMI	-0.031	0.111	0.782	0.1%
RDS	0.015	0.271	0.956	0.0%
Pre-Frail/Frail vs Not Frail	-0.659	1.284	0.609	0.2%
Frailty (Continuous)	-0.411	0.919	0.655	0.2%
Total Vigorous min/wk	0.002	0.003	0.502	0.4%
Total Moderate min/wk	-0.002	0.003	0.435	0.5%
Total Walking min/wk	0.007	0.002	0.739	0.1%
Total MVPA/wk	0.000	0.002	0.894	0.0%
Total PA min/wk	0.889	1.163	0.446	0.5%
6MWT	0.006	0.009	0.536	0.3%

BMI=body mass index; RDS=Rasmussen Disease Score; Mod PA= moderate physical activity, MVPA=moderate to vigorous physical activity; PA=physical activity; 6MWT=six minute walk test

### Summary

This chapter presented the findings related to the research questions, which were developed to explore the relationship between self-efficacy, physical activity and cardiovascular risk in women at moderate to high risk for CVD. Descriptive statistics were used to summarize the demographic data. Bivariate analyses were used to assess the relationship between the key study variables and self-efficacy, in order to identify all influencing factors. No significant correlations were identified between the variables of actual risk (i.e., RDS) and the five types of self-efficacy. Both General and MDSE were found to be positively correlated with different physical activity variables; General SE was found to be positively associated with Moderate Physical Activity and MVPA, while MDSE was positively the 6MWT. MDSE components (i.e., total, task, barrier) were negatively correlated with frailty. Regression analyses revealed that, frailty was a significant predictor toward the outcomes of MDSE components (i.e., total, schedule, barrier), frailty, and the 6MWT were significant predictors of MDSE (task). Regression analysis also demonstrated that the 6MWT was a significant predictor toward the outcome of General SE. No significant correlations were found between any of the study variables and outcome expectations. The following chapter will provide a discussion of the research results.

## **CHAPTER 6: DISCUSSION**

This retrospective, cross-sectional study was designed to examine the relationship between self-efficacy, physical activity, and cardiovascular disease (CVD) risk in women at moderate to high risk for CVD. The findings reported in the previous chapter will be discussed in this chapter, with a focus on the study purpose to explore the relationship between these variables, and specifically, the research questions in the context of previous related research literature. Additionally, the implications and recommendations for nursing practice, education, and research, as well as the study limitations will be discussed, and the strengths and weaknesses of the Health Promotion Model (HPM) will be reviewed.

### **The Health Promotion Model**

The conceptual framework, which guided this investigation, was based on Pender's (2015) Health Promotion Model (HPM). Hence, the discussion of the findings related to the four research questions will be organized within the context of this framework. Demographic characteristics will be discussed within the context of the individual characteristics and experiences. The behavior-specific cognitions and affect section will encompass a discussion related to the research questions. The preceding review of the literature will provide the basis for comparison of this study's findings with previous research.

### **Individual Characteristics and Experiences**

**Personal factors.** The demographic variables in this study included the individual characteristics of age, education, BMI, and frailty. These current findings will be explored within the context of previous research to determine if this sample was representative of the larger population and if these findings are consistent with existing literature on this topic.

The average age of the current study participants was 68 years. A review of research examining the variables associated with CVD risk in female populations, revealed that the majority of this work has included samples of women aged 60 years or younger (Nabi et al., 2010; Shai et al., 2004; Wilson et al., 2002; Wyman, Crum, & Celentano; 2012). However, studies that have focused on the specific variable of self-efficacy for physical activity in samples of women at risk for CVD, have featured women in older age groups, including women in their sixties (Hays, Pressler, Macmush, Rawl, & Clark, 2010; Jerome & McAuley, 2012), and seventies (Dolansky, Zullo, Boxer, Moore, 2011; Yang, Jeong, Kim, & Lee, 2013). Thus, this study sample was comparable to the ages of women used in previous research on this specific topic.

Canadian statistics show that a woman's risk for CVD increases dramatically during and following menopause (Statistics Canada, 2016); similarly, in this study there was a positive correlation between the variables of age and CVD risk (measured by the RDS score). However, unlike most women, the participants in this study were all aware of their CVD risk, as a result of participating in the Happy Hearts Study. This knowledge level is unique to this sample population as previous research has found that most women are not aware of their risk for CVD (Mosca, Hammond, Mochari-Greenberger, Towfighi, & Albert, 2013). Motivation to change CVD risk factors has been shown to increase with age (Galbraith, Mehta, Beledar, Baccarino, & Wenger, 2011). The current sample of older women was, aware of their risk for CVD and, likely highly motivated, as evidenced by their enrolment in the Happy Hearts Study, which must be taken into consideration when interpreting this study data.

Nearly one third (31.7%) of the women in this sample report living alone, which is similar to the general population of women living alone in Canada: Statistics Canada (2016)

reported that 33% of women over the age of 65, and 48.6% of women over the age of 80 live alone. It is important to consider a woman's living situation because research has shown that the social isolation connected to living alone, has been associated with increased risk for CVD (Holt-Lundstad & Smith, 2016; Xia & Li, 2016). The finding that the women in this sample do not have higher rates of living alone indicates that this variable will have similar influence on CVD risk then it has in the general population of Canadian women.

Approximately 75% of the women in this study reportedly had a minimum of post-secondary education. This statistic was significantly higher than the national average for Canadian adults, reported by Statistics Canada (2016) to be 54%. Education is often considered a marker for socio-economic status (SES) and previous research has consistently reported that higher educational levels increase a woman's perceived risk of CVD (Webster & Heeley, 2010). Thus, women in this sample likely had an accurate CVD risk perception owing both to their risk stratification in the Happy Hearts study and to their high levels of education. This awareness would make them well positioned to understand information regarding their health and to follow recommendations.

The average BMI for this sample was 27.5 kg/m<sup>2</sup>, indicating that most women were in the overweight category (BMI between 18.5-24.9 kg/m<sup>2</sup>, Government of Canada, 2015; see Table 1). The highest numbers of overweight women were between the ages of 60-64, slightly younger than the national statistics, which report that the highest percentages of overweight women are in the age group between 55-64 years. The highest number of obese participants were in the 65-69 year old age group (see Table 4), which corresponds to the national average for women which peaks between the ages of 65-74 years (Government of Canada, 2015). Thus the weight gain that these women experienced after turning 60 coincides with the population of women in Canada,

and is most likely attributed to menopause, as well as other factors such as entering retirement, a time of transition, and potential associated change in health behavior (Stenholm, et.al., 2002). These findings reinforce the need to educate women who are transitioning into the menopausal years about the importance of maintaining a healthy lifestyle including weight management and physical activity, in order to reduce the increasing threat of CVD.

Further exploration of the BMI trends in the aging women in this study revealed that the number of women in both the overweight and obese categories peaked and then declined with age. The number of women with BMIs in the overweight category started to decline after the age of 64 years, and the number of women with BMI's in the obese category started to decline after the age of 69 years (see Table 4). This downward trend in average BMI occurred somewhat earlier than what has been reported in research on aging adult populations, where BMI has been shown to peak at 70 and then stabilize or decline (Kahng, Dunkle, & Jackson, 2004; Ogden, Curtin, Tabak, & Flegal, 2008). One reason why this data is not consistent with existing literature may be due to the age distribution of this sample with the majority of the women being between the ages of 60-70 years. The low number of participants over the age of 80 years, may not have been large enough to adequately represent the average BMI of Canadian women in that age group. Another reason for that may explain the differences between this data and previous research could be due to the nature of the sample: a highly active and well educated sample of women. These women were aware of their risks for CVD and this may have translated into motivation to reduce their risk factors such as BMI. These findings suggest caution when applying these study results to the greater population, and they highlight the importance of educating ageing women about the association between increased BMI and CVD risk.

In the correlational analysis, BMI was not significantly associated with CVD risk, as measured by the RDS. Although all of the women in this sample were previously identified as being at moderate to high risk in the Happy Hearts study, the RDS scores were between 3-8 indicating a range in the degree of risk that each participant experienced. The lack of correlation between RDS and BMI does not support previous research, which has consistently demonstrated a positive association between these two variables in female samples (Elisha, Rabasa-Lhoret, Messier, Adbulnour, & Karelis, 2013; Wilson, D'Agostino, Sullivan, Parise, & Kannel, 2002). Of further concern, is that the RDS did not correlate with any other study variables, which have all been previously shown to be positively associated with health behaviors including, physical activity, as measured by self-report or 6MWT (Lear & Yusuf, 2017; Rasiyah et al., 2015; Oyeyemi & Adeyemi, 2013), and cognitive behavioral factors, such as self-efficacy or outcome expectations (Barg, et al, 2012; Buckley, 2016; Duncan, Rodgers, Hall, & Wilson, 2011). The Framingham Risk Score (FRS) has been used extensively in research to predict the risk of CVD over a 10-year period based on the risk factors of age, cholesterol, blood pressure, smoking, and diabetes (D'Agostino et al, 2008). In comparison, the RDS is calculated based on measures of blood pressure and arterial elasticity (Duprez et al., 2011). Previous research has shown that the RDS was a better predictor of cardiovascular events than the FRS in a sample of adults (Duprez et al., 2011). However, the RDS is a relatively new method of assessing for CVD risk and the lack of correlation between these results and known health behaviors suggests that further testing of this tool on female populations is needed.

While only one participant in this study was categorized as frail, 27.5% were pre-frail, and 71.4% were not frail (see Table 2). These results are significantly lower than the frailty estimations about non-institutionalized adults identified in the literature; for example, the

Government of Canada (2010) reported frailty statistics based on data from the Canadian Community Health Survey (CCHS) using the Frailty Index. Frailty was estimated to be 16% between ages 65-74, 28.6% between ages 75-84, and 52.1% over age 85. However, it is important to note that there is currently no single definition of frailty that has been accepted in the healthcare research. Recently, Kehler and colleagues (2017) reported an estimation of the frailty prevalence in Canadians using both the Fried Model (2001) and the Frailty Index (Mitnitski, Mogliner, & Rockwood, 2001). They found that using the Fried Model, frailty was 6.9% in adults ages 50-64, and 7.9% in adults over 65 years, and using the Frailty Index, frailty was much higher (i.e., 11.6% in adults between 50 and 64 years and 20.2% in adults over 65 years). In comparison to both of these measures, the current sample's prevalence of frailty being less than 1% was not representative of Canadian women in these age categories. Several factors likely contributed to the low level of frailty in the current study. As frailty typically increases with age, the relatively younger mean age of this sample may account for the difference. The women in this study were also highly educated and highly active, both of which are factors that have been negatively correlated with frailty (Kehler et al., 2018; Herr, Robine, Aegerter, Arvieu, & Ankri, 2015; Jurschik, Nunin, Botigue, Escobar, & Lavedan, 2012). Therefore, further research with a more representative population of aging and elderly women is warranted.

The only frail participant was in the age category of 60-64 years, and most pre-frail were participants between 60-74 years. This finding does not support existing research, which has consistently shown frailty to increase with age, and thus is more frequent in older age groups (Clegg, Young, Illife, Rickert, & Rockwood, 2013; Fried, 2001; Verma, O'Laughlin, Bunker, Peterson, & Frishman; Xue, 2010). This finding may be attributed to the positive association between BMI and frailty in the current study, as most of the overweight and obese women were

between 60-69 years (see Table 4). This association is supported by previous research, which found higher rates of frailty in the elderly who are either overweight or underweight (Clegg, Young, Iliffe, Rikkert, & Rockwood, 2013; Hubbard, Lang, Llewellyn, & Rockwood, 2010; Mezuk, Lohman, Rock, & Payne, 2016). Women who carry excess weight (i.e., overweight or obese) can experience difficulty with mobility, leading to loss of muscle strength, increased fatigue, and lower levels of physical activity. These changes can all contribute to the development of frailty, as well as CVD risk.

Another potential explanation for the low frailty levels in the current study participants may be their higher than average reported levels of education. The literature supports a negative association between education and frailty, as numerous studies have shown that low SES at any stage in life can be linked to higher levels of frailty in older adulthood (Herr, Robine, Aegerter, Arviu, & Ankri, 2015; Hoogendijk, et al., 2014; Jurschik, Nunin, Botigue, Escobar, Lavedan, & Viladrosa, 20120). The relationship between SES and poor health status is complex, but includes factors that contribute to both frailty and CVD risk, such as: a lack of access to healthcare (Nunes, Thume, Tomasi, Duro, & Facchini, 2014), poor nutrition (Psaltopoulou et al., 2017), low levels of physical activity (Eime, Charity, Harvey, & Payne, 2015) and elevated BMI status (Newton, Braithwaite, & Akinyemiju, 2017). Therefore, findings of this study must be interpreted in light of the specific sample characteristics, recognizing that in the general population women of lower economic status are at particular risk for developing frailty as they age. Since frailty has been associated with increased risk for CVD, efforts must be made to screen middle aged women in all levels of education and SES in order that preventative measures can be taken.

An additional important finding related to frailty was that 27.5% of the current study participants were pre-frail, indicating that they demonstrated 1 or 2 of the frailty phenotypes. This is lower than published estimates reporting pre-frailty to be approximately 42% of community dwelling seniors in high income countries (Collard et al., 2012). Furthermore, the correlational analysis did not show an association between the variables of frailty and CVD risk. This finding is not supported by previous literature which reported that CVD risk is strongly associated with both pre-frailty and frailty (Sergi et al., 2015). However, Sergi et al. (2015) used the modified Fried criteria to measure frailty, and CVD risk was calculated using incident CVD over 4 years, which may explain the discrepancy between these results.

Further insights as to why this sample of women had low frailty rates despite having moderate-high CVD risk were gleaned through an examination of their physical activity data. These findings are discussed in the next section.

### **Past Behaviors: Physical Activity and Physical Fitness**

Physical activity and physical fitness are both health behaviors associated with reduced risk for CVD and, were consequently chosen as variables of interest in this study. According to Pender's HPM, prior related behavior will influence the decision to engage in a considered health behavior; furthermore, a woman's history of engaging in physical activity will inform her thoughts on the behavior (i.e., self-efficacy), and thus may predict her current level of physical fitness. An examination of the participant's self-reported physical activity data (IPAQ) and the physical fitness measures (6MWT) will provide further insight into the health behaviors of this particular study sample. A discussion of this physical activity data within the context of the literature will further clarify whether these results are representative of aging Canadian women.

The women in this study reported high levels of physical activity, including a weekly average of 241 minutes of moderate to vigorous physical activity (MVPA; see Table 5). These numbers are higher than national statistics; Canadian women between the ages of 40-59 report a weekly average of 126 minutes of MVPA, and women between the ages of 60-79 report an average of 84 minutes/week (Statistics Canada, 2016). This sample's above average MVPA levels were seen across all age groups (see Table 6). It is interesting to consider that despite meeting or exceeding Canadian physical activity guidelines of 150 min of MVPA per week, they were all at moderate-high risk of CVD, which suggests that other key risk factors may be present. As previously discussed, the majority of participants were overweight or obese indicating that this is a risk factor that has not been addressed. At first glance, it appears that the women in this sample have had more success in addressing the risk factor of physical activity than the risk factor of overweight and obesity.

A positive correlation was noted between the various types of self-reported physical activity (walking, moderate, vigorous, MVPA) indicating that participants were reportedly active across intensities. However, upon closer examination of the frequency of the self-reported data, almost 50% of the women in every age category reported 0 minutes of vigorous or moderate exercise each week. This finding is further supported by the large standard deviations calculated for each age category, indicating that responses were widely spread from the average. This observation helps in interpreting the higher than average amounts of self-reported physical activity because a considerable segment of the sample clearly reported higher than normal physical activity, which skewed the group averages. This finding serves to provide caution in the interpretation of study data, as averages represent group data which is not necessarily representative of individual responses; additionally, these results may partially explain why a

sample of women who are, on average, highly active are at moderate to high risk for CVD. These findings also reinforce the importance of assessing individuals and not making assumptions based on group data.

When examined by age groups, the distance participants walked during the 6MWT, decreased with each increase in age category (see Table 6). This finding supports previous research literature, which has documented similar declines in physical activity with aging and can be attributed to a number of factors, including decreased muscle strength, flexibility, and endurance (Milanovic, et al., 2013). These findings are important when considering that declining physical activity increases the risk of both frailty and CVD, reinforcing the need for health promotion measures which focus on building muscle strength and flexibility in aging women.

Casanova et al., (2011) published a set of 6MWT reference standards based on the walking test results from healthy subjects in seven countries. They reported that adults aged 60-69, walked an average of 559 meters and those between the ages of 70-80 years, walked an average of 514 meters. The women in the current study averaged longer distances compared to these standards, except for in the group over 80 for which no reference value was provided (see Table 6). These women demonstrated high levels of physical functioning, which supports that they were engaged in physical activity on a regular basis.

The 6MWT is an established measure of physical fitness, which was included in this study to validate the self-reported physical activity data; however, no correlation was found between self-reported physical activities (walking, moderate physical activity, vigorous physical activity) and functionally assessed physical activity (6MWT). This finding is in agreement with previous researchers who have observed that self-reported data does not always accurately

estimate fitness in older women (Fatima et al., 2018). The women in this sample may have overestimated the amount of physical activity they perform due to awareness of their CVD risk and wanting to appear that they were meeting physical activity guidelines.

Previous research has found that self-efficacy is positively associated with physical activity in women (Duncan, Rodgers, Hall, & Wilson, 2011; Rodger, Murray, Selzler, & Norman, 2013; Rodgers, Wilson, Hall, & Murray, 2008); in comparison the women in this study reported higher average levels of exercise specific self-efficacy (task, scheduling, barrier) than younger samples of Canadian adults (Duncan, Rodgers, Hall, & Wilson, 2011). This may be another example of the influence of high education levels on the physical activity behavior in this sample of aging women. While others have reported an association between education and self-efficacy in adult populations (Clark, 1996), further research is needed to confirm this association in aging women at risk for CVD. Furthermore, women at risk for CVD, and highly educated women in particular should receive information on the importance of physical fitness assessment in order to verify that they are in fact engaging in adequate amounts of physical activity.

Walking is considered a form of light intensity physical activity. In this study, the self-reported weekly minutes of walking positively correlated to both vigorous physical activity and moderate-vigorous physical activity (see Table 7), indicating that these women were active at all different intensity levels. However, their self-reported weekly walking was the only self-reported activity variable found to be negatively correlated with the variable of frailty. This finding contradicts a recent study, which reported that only physical activity at a moderate or vigorous intensity levels was negatively correlated with frailty in a population of elderly adults (Rogers et al., 2017). Importantly, the 6MWT was significantly correlated with frailty in the current study

which further supports the contention that fitness does play an important role in frailty. Further research is needed to verify the type and intensity of activity, as well as level of fitness that predicts frailty.

### **Behavior-specific Cognitions and Affect**

Pender (2015) identified that an individual's confidence in his/her own abilities to successfully perform a behavior, as well as the benefit they perceive from engaging in that behavior, will contribute toward the decision to engage in the considered health behavior. This section will explore the results related to the self-efficacy and outcome expectations data, with the goal to discuss the research questions addressed in this project.

**Research Question#1:** *What is the relationship between actual CVD risk and self-efficacy in women at moderate to high risk for CVD?*

In the correlational analysis, the RDS score, as a measure of actual risk for CVD, was not found to be significantly associated with any of the five types of self-efficacy (see Table 7), nor was the RDS score found to significantly contribute to the outcome of any type of self-efficacy in the regression analyses (see Tables 9-14). Although no previous research has explored this specific relationship, these results support the specific nature of self-efficacy and the need for multiple types of risk reduction strategies in reducing CVD risk. For example, previous research has shown that self-efficacy predicts specific health behaviors that reduce CVD risk (Daniali, Eslami, Maracy, Shahabi, & Mostafavi-Darani, 2017; Artinian et al., 2010; Gell & Wadsworth, 2015; Vanden Bosch et al., 2015). However, as self-efficacy is a task-specific confidence, these results suggest that exercise specific self-efficacy (MDSE) may not be all that is required to reduce the risk of CVD in this particular population of women. In other words, a woman may have confidence in her ability to exercise, which correlates with physical activity; however, this

may not be sufficient to reduce her overall CVD risk if she likely has multiple risk factors, such as high blood pressure, high cholesterol, and a high BMI.

It is also important to note that the RDS is capable of detecting the presence of early disease, often before physical symptoms develop; therefore, the RDS is a measurement of a woman's actual risk for CVD but does not necessarily represent how a woman thinks about her risk, or her awareness of risk. A woman's confidence to engage in a health behavior such as exercise, in order to reduce her CVD risk, is likely influenced by her perception of how likely she is to develop this disease. Research on older adults has found that engagement in physical activity had a positive influence on perceived physical health (Wojcicki, et al., 2013). It is possible that the women in this study had a strong sense of confidence in their exercise abilities, which was not influenced by the knowledge that they were at risk of CVD especially if there was no physical evidence of the disease. Further exploration about a woman's experience of risk in relation to her self-confidence to engage in health behavior should be undertaken in order to explore the role of risk perception vs actual risk. There is also a need for further research in this area to include other measures of actual risk in order to establish the optimal measure to use in the assessment of CVD risk in aging women.

In summary, the data did not support a relationship between CVD risk as measured by the RDS, and the outcome of either general self-efficacy or MDSE (total, task, barrier, scheduling). This lack of correlation may be explained by the potential role of awareness and perception of risk in self-efficacy. In addition, further testing of measure of actual CVD risk is central to resolving this research question.

**Research Question #2:** *What is the relationship between individual characteristics (i.e., age, BMI, frailty), past experiences (i.e., physical activity, physical fitness), and self-efficacy for exercise in women at moderate-high risk of CVD?*

**Age and self-efficacy.** General self-efficacy was not found to be significantly associated with age in the correlational analysis. Moreover, the average general self-efficacy scores were similar across each age group (see Table 8), which further supports the notion that self-efficacy does not change with age. This is consistent with previous research reporting that there is no relationship was between age and general self-efficacy in samples of elderly adults (Doba et al., 2016). Thus, as women age their general sense of confidence in their own abilities appears to stay consistent over time, and as such may be more closely associated with general personality traits like an optimistic outlook (Ebstrup, Aadahl, Eplöv, Pisinger, Jørgensen, 2013). Although general self-efficacy does not appear to change as women age, the significance of this type of confidence for the study population will be further explored in relation to the physical activity data.

Age was also not found to be significantly associated with the total MDSE scores or any of the three subtypes (task, barrier, scheduling) in the correlational analyses. This finding is consistent with research by Constanzo and Walker (2008), and Kosteli, Cumming, and William (2018) who reported that when a sample of elderly women engaged in increased physical activity, no change was observed in their exercise self-efficacy beliefs. Conversely, several studies have reported that older women who engage in physical activity display higher levels of exercise related self-efficacy than peers who are less active (Noritake, et al., 2010; Renner, et al., 2007). As well, one study found that the MDSE subtype of barrier self-efficacy was negatively correlated with age (Kosteli, Cumming, & William, 2016), however similar associations were

not identified in this study. An examination of the distribution of MDSE scores according to age groups (see Table 8), reveals that the average self-efficacy score in each MDSE subtype is significantly lower in the oldest age category (80-85 years). The range and of self-efficacy scores in this age category is wide indicating that some of the oldest participants were confident in their ability to exercise while others had very little confidence in their abilities to exercise. This low self-efficacy may be related to the declining physical fitness (6MWT) observed with increasing age (see Table 6). The loss of muscle mass associated with aging can reduce a woman's confidence in her ability to be physically active; however, this confidence can be strengthened through regular physical activity with a focus on the maintenance of muscle mass. The findings on the relationship between exercise self-efficacy and aging must, however, be interpreted with caution in view of the small cell size in this oldest age category ( $n=3$ ), limiting the generalizability of these findings. Further research is needed on the exercise self-efficacy, particularly in women over the age of 80.

**Frailty and self-efficacy.** The impact of physical decline on the exercise self-efficacy of aging women can be further understood by considering the variable of frailty. A significant negative correlation was identified between frailty and MDSE (total), MDSE (task), MDSE (barrier); furthermore, frailty was found to be a significant predictor of all types of MDSE (total, task, barrier, scheduling) in the regression analyses. As women experience the physical deterioration that defines this state, they may begin to lose confidence in their ability to perform an exercise behavior (task self-efficacy), likely due to a lack of physical strength (Maxwell & Wang, 2017). When presented with obstacles to exercise (barrier self-efficacy), women who are frail may not have confidence to overcome hurdles, due to the exhaustion and weakness that are common in frailty (Maxwell & Wang, 2017). Adults who maintain physical fitness as they age

can reduce their risk for frailty and adults who are both pre-frail and frail can slow or reverse their physical decline through regular physical activity (Fairhall, et al., 2011; Jiang, et al., 2017). Previous research by Matsuda, Shumway-Cook, and Ciol (2010) found that in a sample of predominantly elderly women, frailty was negatively associated with exercise self-efficacy. No research was identified that explored the relationship between MDSE and frailty; consequently, these are novel findings which require further testing with a larger, more representative sample of aging women. Additionally, these findings point to the need for early recognition of frailty in aging women and the introduction of appropriate exercise in order to reduce the risks associated with decreased physical activity.

No correlation was found between the variables of frailty and general self-efficacy; additionally, frailty did not predict the outcome of general self-efficacy in the regression analysis. This finding is not in keeping with research that has shown frailty to significantly predict the outcome of general self-efficacy (Doba et al., 2016). Similarly, a recent study showed frailty to be associated with lower levels of general self-efficacy in samples of older adults (Boehlen, et al., 2017). However, these studies used different tools to measure general self-efficacy which may explain the disparate results. Similar to aging, general self-efficacy does not appear to be influenced by the condition of frailty; further supporting the idea that general self-efficacy is more reflective of personality than circumstances. These findings also point to the importance of focusing on exercise specific self-efficacy over general self-efficacy in trying to help women who are frail and wanting to increase their activity levels.

Frailty was entered into the regression analyses as both a continuous variable and as a categorical variable (frail/pre-frail vs not frail). These two approaches were found to be significant for different dimensions of exercise self-efficacy. When measured as a continuous

variable, frailty was predictor for MDSE (total, task, and barrier). However, as a categorical variable, frailty only predicted MDSE (scheduling). Women who scored higher on the Fried Scale (i.e., meet more of the frailty criteria), will have lower physical functioning, which may result in less confidence in their abilities to be physically active, to perform exercises, and to overcome obstacles that they may encounter when exercising. The predictive nature of the categorical frailty measurement implies that even early signs of frailty (i.e., pre-frail) can cause a woman to lose confidence in her ability to plan her exercise activities. The distinction between these two findings is important to consider when screening women for frailty and in understanding how various levels of frailty may impact on a woman's self-efficacy for exercise.

**BMI and self-efficacy.** BMI was also not found to be significantly related to any of the five types of self-efficacy in the correlational analysis; additionally, BMI did not significantly predict the outcome of any type of self-efficacy in the regression analysis. The women in this study reported higher MDSE scores than the baseline scores of a sample of young, obese women who participated in an exercise intervention (Buckley, 2016). Lower exercise self-efficacy scores were also reported in a sample of obese older adults (Annesi, 2011); however, a different MDSE tool was used and so results may not be comparable. The women in the current study had strong general self-efficacy beliefs and strong exercise self-efficacy beliefs, despite being overweight or obese. The significant relationship between BMI and frailty in the correlational analysis suggest that frailty may simply be more important than BMI in predicting self-efficacy than BMI itself. Further research is needed to better understand the associations between BMI and frailty on the outcome of self-efficacy in aging women.

**Physical measures and self-efficacy.** The 6MWT was found to be significantly associated with the MDSE (total, task) in the initial correlational analysis. The 6MWT was also

found to significantly predict the outcome of MDSE task self-efficacy in the regression analysis. Since the 6MWT is a functional assessment of physical fitness, women who maintain regular physical activity will presumably be capable of walking a longer distance during this test. This finding contributes to the small body of literature that has established an association between exercise self-efficacy and physical activity behavior in women at risk for heart disease (Duncan, Rodgers, Hall, & Wilson, 2011; Janssen, Dugan, Karavolos, Lynch, & Powell, 2013; Yang, Jeong, Kim, & Lee, 2013) furthermore, this study provides data on the previously unstudied population of older Canadian women at risk for CVD. These results establish the importance of exercise specific self-efficacy in women who want to engage in physical activity and are physically fit. In order to strengthen MDSE, it is important for women to develop mastery over the specific skill that they want to perform (task self-efficacy). Interventions are needed to build MDSE in aging women in order for this type of confidence to result in physical activity behavior, which in turn will improve physical functioning and reduce the risks associated with aging, including both frailty and CVD.

An important component of this study was the use of the multidimensional self-efficacy tool (i.e., MDSE), which proposes that multiple types of confidence are needed in order to successfully engage in physical activity behavior (Rodgers, Wilson, Hall, Fraser, & Murray, 2008). The results of the correlational analysis showed that only the total MDSE score and the task subscore were associated with physical fitness (see Table 7). These findings are consistent with previous research on the subtypes of exercise self-efficacy, which have found that task self-efficacy is important in the initial adoption of behavior (Faulkner, Westrupp, Rousseau, & Lark, 2013; Frank et al., 2011; Rodgers, Murray, Selzler, & Norman, 2013); but others have found that scheduling (Murray & Rodgers, 2012; Rodgers et al., 2013), and barrier self-efficacy (Burns &

Evon, 2007; Dolansky, Stepanczuk, Charvat, & Moore, 2010) are necessary for long term exercise adherence. It is important to note that the previous research on this topic has been done on predominantly male samples, so the findings from this study are important; both for testing this specific MDSE tool, and for understanding the unique self-efficacy beliefs of aging women at risk for CVD.

In summary, confidence to exercise in this population of aging women was closely linked to how well their physical functioning and frailty. The amount of frailty influenced which subtype of MDSE would be affected. The absence of frailty predicted confidence to schedule exercise, while an increased Fried Frailty score was linked to a lack of confidence in exercising, in performing the behavior, and in overcoming obstacles related to the behavior. MDSE was found to be closely associated with a functional exercise measurement however, confidence in this domain was not associated with reduced BMI, which may partly explain why these women have moderate-high CVD risk.

**Research Question #3:** *What is the relationship between self-efficacy for exercise and general self-efficacy in relation to the behavior of physical activity?*

In the correlation analysis general self-efficacy beliefs were found to significantly associated with MDSE (total), and MDSE (task). General self-efficacy was found to be significantly associated with self-reported moderate physical activity and moderate-vigorous physical activity in a correlational analysis. Upon further assessment of these two variables in the regression analysis, only moderate physical activity was a significant predictor of general self-efficacy. These finding support two previous studies, which reported that increases in general self-efficacy corresponded with increases in physical activity behavior (Miao, Gan, Gan, and Zhou, 2017; Poortaghi et al., 2013). As previously discussed, general self-efficacy reflects an

overall sense of confidence in one's abilities; therefore, women who are confident in their own abilities would consider themselves capable of performing higher levels of exercise. However, the lack of correlation between general self-efficacy and the 6MWT leads one to question the accuracy of the self-reported data as high levels of self-reported physical activity should correlate with distance walked. While general self-efficacy may instill general confidence, it may not accurately predict actual activity performance in aging women. Further research should be done to better understand the relationship between general self-efficacy and both self-reported and actual physical activity measurements.

MDSE (total) and MDSE (task) were both found to be significantly associated with the 6MWT. Regression analysis found that frailty was a significant predictor in the outcomes of MDSE (total), MDSE (task), MDSE (barrier), and MDSE (scheduling). These findings suggest that women who demonstrate confidence in their abilities to be physically active, are likely engaging in regular exercise behavior; for example, women who are confident in the task of walking will likely achieve higher scores on the 6MWT. In comparison, women who are pre-frail or frail and experiencing any of the frailty phenotypes such as fatigue, weakness, or exhaustion will not have confidence in their abilities to be physical active. Women who are pre-frail/frail may have less confidence in their ability to walk (i.e., task self-efficacy) due to muscle weakness and poor balance which can lead to a fear of falling, resulting in slower walking speeds and avoidance of this behavior (Hackstaff, 2009). Interestingly, slow walking speed in elderly adults has been shown to be the frailty phenotype best able to predict future CVD (Sergi, et al., 2015). Women who are pre-frail are beginning to experience a decline in physical functioning which results in a lower reserve and less confidence to handle disruptions such as obstacles to exercise (barrier self-efficacy). Women who frail require strengthening of their self-efficacy to become

physically active so that they can engage in this health behavior which will build muscle mass and improve physical functioning. Women who are pre-frail deserve special attention because they greatly reduce the risk of frailty with regular physical activity and strong exercise self-efficacy is the key to changing this behavior (Hackstaff, 2009).

General self-efficacy was found to correlate with self-reported activity measures but not with the objective measure of physical fitness (i.e., 6MWT) which suggests that women who are generally confident in their abilities may over estimate the amount of physical activity that they perform. The more accurate assessment of physical activity was seen in the strength of a women's exercise self-efficacy and in the specific confidence associated with performing the exercise task (i.e., walking). Importantly, women who are pre-frail were shown to have lower confidence to exercise (MDSE total), to perform exercise behavior (MDSE task), and to overcome obstacles to exercise (barrier self-efficacy). These findings highlight the need for nurses to focus on assessing and strengthening the exercise self-efficacy in aging women, especially for those who are showing early signs of physical decline (i.e., pre-frail).

**Research Question #4:** *What is the relationship between self-efficacy and outcome expectations for women at risk for CVD?*

No significant correlations were found between any of the study variables and women's exercise outcome expectations. Additionally, outcome expectations did not significantly contribute towards the outcome of any type of exercise self-efficacy or to general self-efficacy. These findings support previous research which has not found a relationship between outcome expectations and self-efficacy related to physical activity (Hays et al., 2010; King, Taylor, Haskell, DeBusk, 1989). Although women may be motivated to exercise by the potential benefits of physical activity (i.e., weight loss, fitness, stress reduction), their confidence to exercise is not

connected to these outcomes. This finding is important when considering strategies on how to communicate with women who are considering becoming physically active and that a focus on building their confidence may be more effective than listing the benefits of physical activity.

### **Summary**

In summary, the average participant in this study was an aging, well-educated, non-frail, obese, and highly active. A unique feature of this group was that, by virtue of participating in the Happy Heart Study they were all aware of their moderate-high risk for CVD. CVD risk was surprisingly not associated with the traditional risk factors of frailty and BMI, suggesting that important risk factors may have been overlooked in this study. Although the women in this sample demonstrated strong exercise self-efficacy beliefs, overall this was not sufficient to achieve a normal BMI or to reduce their risk for CVD. A possible reason for this discrepancy may be a lack of perceived threat of this disease or a lack of confidence to manage other health behaviors such as healthy eating.

Frailty was found to have a significant effect on the participant's confidence in their ability to successfully engage in an exercise behavior and to overcome obstacles that they may face related to engaging in physical activity. From a functional standpoint, the more frailty phenotypes these women possessed, the less distance they would be able to walk. Women who were confident in their ability to exercise, demonstrated longer walking distances. Interestingly, women who reported strong general self-efficacy were more likely to report higher levels of physical activity which did not correspond with an ability to perform on a walking test and suggested that this self-reported data was over-estimated.

Finally, perception of the benefits associated with engaging in exercise behavior was not found to influence the participant's confidence to be physically active. This finding has

implications for the focus of strategies to engage women in physical activity, which will be discussed in the next section.

### **Implication and Recommendations**

As the population ages, women will make up an increasingly significant proportion of Canadians who are diagnosed with CVD. If nurses hope to address this problem, health promotion efforts must be developed to reduce the CVD risk that aging women face. Past research has identified that physical activity is an effective method to reduce cardiovascular risk in women. In this study, self-efficacy for exercise was shown to strongly correlate with a woman's exercise behavior. However, the results of this study also point to the negative impact that frailty can have on a women's confidence to engage in physical activity. Nurses must consider strategies to reduce aging women's CVD risk through effective nursing interventions in the area of clinical practice, education, and research.

### **Clinical Nursing Practice**

All allied health professionals with a scope of practice that includes physical activity should be actively engaged in teaching their clients about the benefits of this behavior. Research shows that the most effective way to provide education on the importance of physical activity is for an individual to hear a simple message, from multiple health care providers, on frequent occasions (Brawley & Latimer, 2007; Knox, Webb, Eslinger, Biggle, & Sherar, 2014;). As nurses are the largest group of healthcare professionals and generally spending the most time with patients, they are well situated to participate in the delivery of this information.

Nurses working in the community should play a central role in developing strategies to improve women's physical activity levels through theory-based interventions aimed at building exercise self-efficacy beliefs. An important part of building confidence is to establish a trusting

relationship with a client and as nurses are consistently named as the most trusted profession (Milton, 2017); they are ideally situated to achieve this outcome. Nurses use theory and evidence to guide their practice; therefore, the four sources of self-efficacy and the evidence from this study and previous research should be used to guide nursing interventions aimed at improving self-efficacy for exercise.

Nurse practitioners (NPs), “provide comprehensive care to clients of all ages, using principles of health promotion and disease prevention” (Canadian Nurses Association, 2016, p.1). NPs working in primary care settings are ideally suited to perform risk assessments for both CVD and for frailty as they often have the opportunity follow clients over time and can observe patterns of behavior. As NPs perform holistic assessments, encompassing a physiological as well as a psychological component, they should include assessment of self-confidence related to current behaviors and recommendations for behavior changes. In order to effectively reduce CVD risk, all women, especially approaching menopausal years, should be screened. NPs should design treatment plans for women who are at risk for CVD and/or frailty, including an emphasis on engaging in regular physical activity. These treatment strategies should be developed, implemented, and evaluated in collaboration with a multidisciplinary team, based on the Exercise is Medicine Canada guidelines (2018).

The emerging My Health Team initiative, in the province of Manitoba, may be an ideal setting for nurses to take a leading role in CVD risk reduction for women in the community setting. “My Health Team brings together teams of providers with different expert knowledge and skills to care for patients” (Manitoba Center for Health Policy, 2017, p.3). Nurses have strong leadership skills and are well suited to lead a multidisciplinary team to establish CVD risk reduction interventions for aging women in the community setting. This type of intervention

could provide opportunity for mastery experiences, such as walking or using exercise equipment in a supervised environment. Vicarious learning could occur in organized group activities in which women can observe their peers engage in physical activity. Additionally, this group setting an important source of social support that aging women need and which would further reduce their risk for CVD by lessening social isolation. Members of the multidisciplinary team (e.g., nurses, dieticians, kinesiologists, physiotherapists, occupational therapists) could provide education sessions, with the goal to increase knowledge, along with verbal persuasion. Nurses can use their effective communication skills to talk to women about their emotions surrounding exercise, another way to strengthen self-efficacy beliefs. This approach to improving aging women's exercise self-efficacy should contribute to increased healthy behaviors, improved social support, and decreased CVD risk.

Another new community initiative in the WRHA is the healthy aging resource team, consisting of two health care professionals one of whom can be a nurse. The goal of these teams is to promote health and manage chronic disease in adults over the age of 55. Nurses are strong collaborators, accustomed to working with a variety of healthcare professionals and would thrive in this health promotion setting. Nurses could provide leadership to these teams, establishing priorities of addressing aging women's unique risk for CVD. Although physical activity is important, this study also identified the contribution of BMI toward both frailty and CVD risk. These management teams could offer weight loss interventions incorporating the role of behavior specific self-efficacy. As the findings of this study have suggested, aging women may overestimate their physical activity levels, which could be addressed through education strategies aimed at assessing if women are engaging in an appropriate amount of exercise. Furthermore,

these teams could deliver risk awareness to women through other education strategies and screening opportunities.

Finally, nurses working in long term care have an important role to play in addressing the CVD risk factor of frailty in their aging female population. Nurses who provide 24 hour care to long term patients, have the assessment skills needed to identify early signs of physical decline which precede the onset of frailty. When frailty is identified, nurses must employ evidence based care plans for managing these high risk patients. Although evidence is lacking on how to best manage frailty, physical activity is the overarching intervention for use in both preventing and managing this syndrome (Maxwell & Wang, 2017). Long-term care nurses must advocate for their patients who are frail and help to establish activity programs that can strengthen muscle tone and improve outcomes.

### **Nursing Education**

Nursing education about CVD risk in women must start in the undergraduate nursing programs. Student nurses must learn about the unique CVD risk factors experienced by aging women, as well as the role of health behaviors in managing those risks. They need to learn that women are typically less active than men and strengthening of exercise self-efficacy beliefs may be an effective strategy for improving physical activity in women. Nursing program curricula that include these components will ensure that nurses will learn to bring this knowledge into every interaction with an aging woman.

Clinical nurse specialists are an important link between research and clinical practice. Clinical nurse specialists “advance the professional by contributing to the development of nursing knowledge and evidence-based practice and by promoting excellence in clinical practice” (Canadian Nurses Association, 2016, p.1). These advanced practice nurses are aware of

best practice guidelines and can inform evidence-based care of women at risk for CVD.

Therefore, they are ideally situated to educate nurses in clinical practice about the latest evidence related to CVD risk in women and the importance of self-efficacy in physical activity behaviors. CNSs must also work to connect the evidence on frailty with current clinical practice, as this has been identified as an area of concern especially when considering the poor health outcomes in this population. Finally, clinical nurse specialists are experts in developing, implementing, and evaluating policies and guidelines and are therefore well suited to lead a multidisciplinary team in the quest for improving cardiovascular health outcomes in women.

Many practicing nurses may not be aware of women's risk for CVD, and more specifically, about the importance of exercise self-efficacy in their female patients and the impact that this will have on their CVD risk. Nurses must be provided with the opportunity to learn about how CVD presents uniquely in women and about their non-traditional risk factors. Although CVD primarily affects women after menopause, nurses must recognize that most of the damage begins occurs from unhealthy behaviors that start in youth. Nurses must also be educated about the concept of frailty and its association with CVD risk. Strategies to address clinical nurses' gap in knowledge may include in-service education sessions, on-line learning modules, journal clubs, nursing rounds presentation, or in simulation scenarios. When nurses are well informed about women's CVD risk, will they be able to provide comprehensive care and education to their female patients.

### **Nursing Research**

Although a significant amount of research has been done on the relationship between exercise self-efficacy and physical activity, this study is unique in its focus on aging Canadian women. Demographics revealed that the study population was not very representative of the

average older Canadian women and therefore further research on a more representative sample is warranted. Furthermore, only a small amount of the variance in our self-efficacy outcomes were explained, suggesting that key predictor variables may have been missing from the study data. Therefore, future research on aging women at risk should include more potential predictor variables, such as blood pressure, depression, and pregnancy–related complications.

Although frailty was found to be a significant variable in this study, research is needed on how to best identify women at risk for frailty, and how to manage this syndrome. The large variety of frailty screening tools that have been developed and utilized in recent research has led to confusion and a lack of best practice. Nurse researchers must add their voice to the frailty dialogue and push for consensus guidelines on how best to manage this decline in function.

Nurses should continue to study women at risk for CVD using different methodologies, such as prospective cohort studies. This type of longitudinal research gathers information over time and thus could identify behavior patterns which are not possible to detect in a cross-sectional design. Of further interest is how women respond to learning that they are at risk for CVD and whether this knowledge has an impact on their perception of risk and their risk reducing behavior. Future research should also explore the interaction between women's perceived risk of CVD vs their actual CVD risk. Another methodology to consider for future research is a randomized trial, to determine the effect of participating in an exercise intervention on a woman's exercise self-efficacy. Finally, qualitative research is needed to explore the lived experiences of women at risk for CVD, in order to achieve a greater understanding of their experience and to learn about their motivations related to behavior change. This type of data would be helpful in identifying additional personal factors and prior related behaviors that may influence women's self-efficacy, but were not included in the present study.

Nurses also need to continue to contribute to the limited body of research exploring interventions that will benefit patients who are pre-frail and frail. There is currently lack of consensus on the type and quantity of physical activity that would most benefit those at risk for frailty. Continued research is also warranted on the association between self-efficacy and frailty to further establish how these concepts interact.

Future nursing research should also focus on additional testing of the multidimensional self-efficacy for exercise tool. Although one significant predictor of exercise self-efficacy was identified, it was only able to account for a small percentage of the variance in this outcome. Further research should be done on larger samples of women at risk for CVD to test additional predictor variables in order to better understand the ways in which self-efficacy is shaped. This knowledge would inform the design of future interventions aimed at building women's self-confidence to be physically active and reduce their risk for CVD.

In summary, clinical nurses are ideally positioned to take a leadership role in establishing changes aimed at reducing women's risk of CVD and frailty. Advanced practice nurses have the knowledge and expertise to take a leadership role in multidisciplinary teams aimed at reducing CVD risk for women through the development of community interventions focused on strengthening health behavior. Primary care and long-term care nurses should incorporate screening for CVD and frailty, and assessment of self-efficacy beliefs into their holistic approach to the assessment of women. Nurses at all levels must be educated on factors influencing CVD risk in women and, the frailty syndrome, and how both can be largely prevented through regular physical activity. Finally, nurse researchers must prioritize intervention studies aimed at building exercise self-efficacy in all aging women, especially those who are pre-frail. This type of

research can inform in the development of policy and intervention to manage CVD and frailty risk in women.

### **Conceptual Framework**

Pender's Health Promotion Model (HPM; 2015) provided an appropriate framework for guiding the literature review and for providing structure in the development of the research questions and the discussion. The HPM was instrumental in helping to identify the components of health behavior including the primary concept of interest, self-efficacy. As a beginning researcher, this framework was useful in establishing structure to the research questions and in helping to organize, the review of the literature, the data analysis, and the discussion.

The strength of the HPM was its focus on the holistic nature of health behavior, allowing for the inclusion of a wide variety of variables within the categories of past experiences and individual characteristics. Additionally, this model emphasized the contribution of cognitive influences toward the decision to adopt a health behavior which allowed for the study's focus on self-efficacy beliefs. Thus, overall, the HPM was an appropriate framework to explore the relationship between self-efficacy and CVD risk in aging women.

### **Limitations of the Study**

A major limitation in this study was the retrospective design which prescribed the variables that could be considered as influencing factors on the outcome of self-efficacy; however, key variables of interest were included in the original data collection. Recruitment of the sample was another limitation, as these women volunteered to participate contributing to volunteer sampling bias. The result of this type of sampling was a less representative group of women who were highly educated, and highly physically active. Additionally, the women in this sample were all identified as being at moderate to high risk for CVD in the Happy Hearts study,

contributing to the homogeneity of the sample and potentially explaining why RDS did not emerge as a significant predictor variable. However, the sample had a good cross section of ages and very low levels of attrition. As well, frailty was underrepresented in the older population as none of the women over the age of 65 years were frail. This sampling bias was unfortunate because a major finding of this study was the importance of frailty as a predictor of self-efficacy. Furthermore, the scoring for the Fried frailty scale that was used in this study was based on a sample population with an average age of 80 years, much older than our sample. This limitation could be addressed through the development of an adjusted Fried Frailty Scale, which would more accurately assess frailty in a younger population. However, this study did establish novel evidence related to frailty and the impact of this variable on aging women's exercise self-efficacy beliefs. Another possible limitation was the tools used in this study. The 4-test RDS that was used to assess CVD risk is relatively new and preliminary testing is currently underway. The lack of correlation between the RDS score and any of the variables associated with high risk (i.e., BMI, low physical activity, low fitness, frailty) was unexpected and indicates the need for further testing of this tool. Self-efficacy is also a complex concept, with mixed evidence related to physical activity, particular; further testing of self-efficacy instruments is also required.

### **Chapter Summary**

A discussion of the results of this study was presented in this chapter. The demographic data revealed that although the women in this sample were at moderate-high CVD risk, they were also well educated and highly active. General self-efficacy was found to be influence self-reported data, while MDSE was correlated with actual physical behavior (i.e., 6MWT walking distance). Frailty was found to be the most important predictor of the outcome of self-efficacy in

this sample of aging women. Outcome expectations did not interact with any other study variable, including self-efficacy beliefs.

Nurses working in areas of clinical practice, education, and research are well positioned to be leaders in CVD risk reduction. Nurses are able to address both CVD risk and frailty risk in their aging female patients through exercise interventions, inter-professional collaboration, policy development, and focused screening assessments. Nurses must be provided with opportunities to learn about the CVD risk that women face as they age and about the important role of physical activity in reducing that risk, which in turn should be shared with their female patients and their peers. Finally, further research is needed on the topic of aging women at risk for CVD. This research should include longitudinal studies to identify behavior patterns, inclusion of more variables to better predict the outcome of self-efficacy, larger, more representative samples of the aging female population, and frailty tools. However, the data from this study revealed important and novel results about the self-efficacy, physical activity, frailty, and CVD risk in sample of women who were at moderate to high risk for CVD.

### **Thesis Summary and Conclusion**

All women face the threat of heart disease, but the risk rises substantially with age, specifically during and after menopause. Although physical activity has been shown to greatly reduce the risk of CVD in women, most women do not meet minimal physical activity guidelines. Self-efficacy has been identified as a significant predictor of physical activity behavior in women of all ages; therefore, the purpose of this study was to explore the relationship between CVD risk and self-efficacy in women at moderate to high risk for CVD. Relationships between individual characteristics, past experiences, outcome expectations and five types of self-efficacy beliefs were examined.

The Health Promotion Model provided an appropriate organizing framework for this study. The influences of individual characteristics and experiences, as well as behavior-specific cognitions were contemplated in terms of their influence on self-efficacy. This framework was found to be an effective guide for the literature review, data analysis, and discussion related to this study.

The thesis study used a retrospective design to explore the relationship between the study variables and the outcome of self-efficacy. Multiple variables were significantly associated with self-efficacy, including the 6MWT and frailty. In the multivariable regression analyses, frailty emerged as a significant predictor for MDSE (total, schedule, barrier), and both frailty and the 6MWT predicted the outcome of MDSE (task). Only moderate self-reported activity predicted general self-efficacy in the regression model.

These study results highlight the need for several key nursing interventions that would benefit aging women at risk for CVD. First, nurses must take a leadership role and work with multi-disciplinary health teams to ensure that women receive the fundamental and essential education about the growing risk for CVD as they age, as well as the important role or regular physical activity in controlling their risk. Nurses need to work with other healthcare professionals to develop strategies to empower women to develop a strong sense of self-efficacy and the adoption of exercise behaviors. This study has identified novel evidence related to the negative influence of frailty on women's confidence to be physically active. Nurses are optimally positioned to lead the fight against frailty in aging women by developing assessment tools, educating women and the public about this condition, and designing interventions aimed at optimizing women's health in order to avoid this destructive pattern of aging. Finally, further research is needed to understand the exercise beliefs of a more representative sample of women

at moderate-high risk for CVD, including a representative number of frail women who are at highest risk for poor health outcomes.

As women age they are faced with an increasing threat of CVD. Physical activity has been found to greatly reduce this risk however, most women do not engage in this health behavior. The purpose of this study was to explore whether CVD risk was associated with exercise self-efficacy beliefs in aging women. Frailty was found to have an important effect on women's exercise self-efficacy. These findings further highlight the need for aging women to stay physically active in order to avoid both the risk of frailty and CVD.

### References

- Abdelmoneim, S. S., Bernier, M., Hagen, M. E., Eifert-Rain, S., Bott-Kitslaar, D., Wilansky, S., ... Mulvagh, S. L. (2013). A multicenter, prospective study to evaluate the use of contrast stress echocardiography in early menopausal women at risk for coronary artery disease: trial design and baseline findings. *Journal of Women's Health, 22*(2), 173–183.  
<https://doi.org/10.1089/jwh.2012.3714>
- Abdolaliyan, N., Shahnazi, H., Kzemi, A., & Hasanzadeh, A. (2017). Determinants of the self-efficacy of physical activity for maintaining weight during pregnancy: The application of the health belief model. *Journal of Education and Health Promotion, 6*(1), 35–40.  
<https://doi.org/10.4103/jehp.jehp>
- Affilalo J , Alexander KP , Mack MJ , et al. Frailty assessment in the cardiovascular care of older adults. *Journal of American College of Cardiology* 2014;63:747–62  
doi:<http://dx.doi.org/10.1016/j.jacc.2013.09.070>
- Ahmadi, A. (2016). Social Support and Women's Health. *Women's Health Bulletin, 3*(1), 1–5.  
<https://doi.org/10.17795/whb-31083>
- Akil, L., & Ahmad, H. A. (2011). Relationships between obesity and cardiovascular diseases in four southern states and Colorado. *Journal of Health Care for the Poor and Underserved, 22*(4A), 61–72. <https://doi.org/10.1353/hpu.2011.0166>
- American Heart Association (2015). Menopause and heart disease. Retrieved from <http://www.heart.org/HEARTORG/Conditions/More/MyHeartandStrokeNews/Menopause-and-Heart-Disease>
- Annesi, J. J. (2011). Self-regulatory skills usage strengthens the relations of self-efficacy for

improved eating, exercise, and weight in the severely obese: Toward an explanatory model. *Behavioral Medicine*, 37(3), 71–76. <https://doi.org/10.1080/08964289.2011.579643>

Ansari, W. El, & Lovell, G. (2009). Barriers to exercise in younger and older non-exercising adult women: A cross sectional study in London, United Kingdom. *International Journal of Environmental Research and Public Health*, 6(4), 1443–1455. <https://doi.org/10.3390/ijerph6041443>

Arbeit, M. L., Johnson, C. C., Mott, D. S., Harsha, D. W., Nicklas, T. A., Webber, L. S., & Berenson, G. S. (1992). The Heart Smart cardiovascular school health promotion: behavior correlates of risk factor change. *Preventive Medicine*, 21(1), 18–32.

Artinian, N. T., Fletcher, G. F., Mozaffarian, D., Kris-Etherton, P., Van Horn, L., Lichtenstein, A. H., ... Burke, L. E. (2010). Interventions to promote physical activity and dietary lifestyle changes for cardiovascular risk factor reduction in adults: A scientific statement from the American Heart Association. *Circulation*, 122(4), 406–441. <https://doi.org/10.1161/CIR.0b013e3181e8edf1>

Ashford, S., Edmunds, J., & French, D. P. (2010). What is the best way to change self-efficacy to promote lifestyle and recreational physical activity? A systematic review with meta-analysis. *British Journal of Health Psychology*, 15(2), 265–288. <https://doi.org/10.1348/135910709X461752>

Baer, J. T. (1993). Improved plasma cholesterol levels in men after a nutrition education program at the worksite. *Journal of the American Dietetic Association*, 93(6), 658–663.

Bailey Merz, C. N., Andersen, H., Sprague, E., Burns, A., Keida, M., Walsh, M. N., ... Robinson, B. (2017). Knowledge, attitudes, and beliefs regarding cardiovascular disease

in women: The women's heart alliance. *Journal of the American College of Cardiology*, 70(2), 123–132. <https://doi.org/10.1016/j.jacc.2017.05.024>

Ball, G., Campbell, K., Burke, N., Pericleous, L., & Tarride, J. (2016). Indirect costs associated with cardiovascular disease in Canada: A literature review. *Value in Health*, 19(3), A49. <https://doi.org/10.1016/j.jval.2016.03.122>

Ball, K., Crawford, D., & Owen, N. (2000). Too fat to exercise? Obesity as a barrier to physical activity. *Australian and New Zealand Journal of Public Health*, 24(3), 331–333. <https://doi.org/10.1111/j.1467-842X.2000.tb01579.x>

Bandura, A. (1986). *Social foundations of thought and action : A social cognitive theory*. Englewood Cliffs, N.J.: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy : The exercise of control*. New York: NY : W.H. Freeman.

Barg, C. J., Latimer, A. E., Pomery, E. A., Rivers, S. E., Rench, T. A., Prapavessis, H., & Salovey, P. (2012). Examining predictors of physical activity among inactive middle-aged women: An application of the health action process approach. *Psychology and Health*, 27(7), 829–845. <https://doi.org/10.1080/08870446.2011.609595>

Barkley, S. A., & Fahrenwald, N. L. (2013). Evaluation of an intervention to increase self-efficacy for independent exercise in cardiac rehabilitation. *Behavioral Medicine*, 39(4), 104–110. <https://doi.org/10.1080/08964289.2013.804804>

Bauer, C., Graf, C., Platschek, A. M., Strüder, H. K., & Ferrari, N. (2017). Reasons, motivational factors and perceived personal barriers to engagement in physical activity during pregnancy vary within the BMI classes - The prenatal prevention project Germany. *Journal of Physical Activity & Health*, 1. <https://doi.org/10.1123/jpah.2016-0563>

Bauman, A. E., Reis, R. S., Sallis, J. F., Wells, J. C., Loos, R. J. F., & Martin, B. W. (2012).

Correlates of physical activity: Why are some people physically active and others not? *The Lancet*, 380(9838), 258–271. [https://doi.org/10.1016/S0140-6736\(12\)60735-1](https://doi.org/10.1016/S0140-6736(12)60735-1)

Becker, M. (1974). *The Health Belief Model and personal health behavior*. Thorofare, NJ: Charles B. Slack.

Bélanger, M., Sabiston, C. M., Barnett, T. A., O’Loughlin, E., Ward, S., Contreras, G., & O’Loughlin, J. (2015). Number of years of participation in some, but not all, types of physical activity during adolescence predicts level of physical activity in adulthood: Results from a 13-year study. *International Journal of Behavioral Nutrition and Physical Activity*, 12(1), 1–8. <https://doi.org/10.1186/s12966-015-0237-x>

Bellamy, L., Casas, J.-P., Hingorani, A. D., & Williams, D. J. (2007). Pre-eclampsia and risk of cardiovascular disease and cancer in later life: systematic review and meta-analysis. *Bmj*, 335(7627), 974–974. <https://doi.org/10.1136/bmj.39335.385301.BE>

Bellet, R. N., Adams, L., & Morris, N. R. (2012). The 6-minute walk test in outpatient cardiac rehabilitation: Validity, reliability and responsiveness—a systematic review. *Physiotherapy*, 98(4), 277–287. <https://doi.org/10.1016/j.physio.2011.11.003>

Bennett, K. K., Adams, A. D., & Ricks, J. M. (2012). Pessimistic attributional style and cardiac symptom experiences : Self-Efficacy as a mediator. *North American Journal of Psychology*, 14(2), 293–306.

Berlin, K., Kruger, T., & Klenosky, D. B. (2016). A mixed-methods investigation of successful aging among older women engaged in sports-based versus exercise-based leisure time physical activities. *Journal of Women and Aging*, 30(1), 1–11.

<https://doi.org/10.1080/08952841.2016.1259439>

Bittencourt, M. S. (2018). Health promotion: A step beyond prevention in cardiology. *American Heart Journal*, *198*, 178–179. <https://doi.org/10.1016/j.ahj.2017.11.003>

Bittner, V., DH, W., Yusuf, S., & al, et. (1993). Prediction of mortality and morbidity with a 6-minute walk test in patients with left ventricular dysfunction. *JAMA*, *270*(14), 1702–1707. [doi.org/10.1001/jama.1993.03510140062030](https://doi.org/10.1001/jama.1993.03510140062030)

Blair, S. N., Haskell, W. L., Ho, P., Paffenbarger, R. S. J., Vranizan, K. M., Farquhar, J. W., & Wood, P. D. (1985). Assessment of habitual physical activity by a seven-day recall in a community survey and controlled experiments. *American Journal of Epidemiology*, *122*(5), 794–804.

Blanchard, C., Arthur, H. M., & Gunn, E. (2015). Self-efficacy and outcome expectations in cardiac rehabilitation: Associations with women's physical activity. *Rehabilitation Psychology*, *60*(1), 59–66. <https://doi.org/10.1037/rep0000024>

Blanchard, C. M., Courneya, K. S., Rodgers, W. M., Daub, B., Knapik, G., & Rogers, W. M. (2002). Determinants of exercise intention and behavior during and after phase 2 cardiac rehabilitation: An application of the theory of planned behavior coronary heart disease (CHD) remains the leading cause of death in the United. *Rehabilitation Psychology*, *47*(3), 308–323. <https://doi.org/10.1037//0090-5550.47.3.308>

Blanchard, C. M., Courneya, K. S., Rodgers, W. M., Fraser, S. N., Murray, T. C., Daub, B., & Black, B. (2003). Is the theory of planned behavior a useful framework for understanding exercise adherence during phase II cardiac rehabilitation? *Journal of Cardiopulmonary Rehabilitation*, *23*(1), 29–39. <https://doi.org/10.1097/00008483-200301000-00007>

Blanchard, C. M., Reid, R. D., Morrin, L. I., Beaton, L. J., Pipe, A., Courneya, K. S., &

Plotnikoff, R. C. (2007). Barrier self-efficacy and physical activity over a 12-month period in men and women who do and do not attend cardiac rehabilitation. *Rehabilitation Psychology, 52*(1), 65–73. <https://doi.org/10.1037/0090-5550.52.1.65>

Blanchard, C. M., Reid, R. D., Morrin, L. I., McDonnell, L., McGannon, K., Rhodes, R. E., ...

Edwards, N. (2011). Understanding physical activity during home-based cardiac rehabilitation from multiple theoretical perspectives. *Journal of Cardiopulmonary Rehabilitation and Prevention, 31*(3), 173–180. <https://doi.org/10.1097/HCR.0b013e3181ff0dfe>

Blanchard, C. M., Rodgers, W. M., Courneya, K. S., Daub, B., & Black, B. (2002). Self-efficacy

and mood in cardiac rehabilitation: Should gender be considered? *Behavioral Medicine, 27*(4), 149–160. <https://doi.org/10.1080/08964280209596040>

Booth, F. W., Roberts, C. K., & Laye, M. J. (2012). Lack of exercise is a major cause of chronic diseases. *Comprehensive Physiology, 2*(2), 1143–1211.

<https://doi.org/10.1002/cphy.c110025.Lack>

Boehlen, F. H., Herzog, W., Schellberg, D., Maatouk, I., Saum, K.-U., Brenner, H., & Wild, B.

(2017). Self-perceived coping resources of middle-aged and older adults – results of a large population-based study. *Aging & Mental Health, 21*(12), 1303–1309. <https://doi.org/10.1080/13607863.2016.1220918>

Boreskie, K. F., Kehler, D. S., Costa, E. C., Cortez, P. C., Berkowitz, I., Hamm, N. C., ...

Duhamel, T. A. (2017). Protocol for the HAPPY Hearts study: cardiovascular screening for the early detection of future adverse cardiovascular outcomes in middle-aged and older

women: a prospective, observational cohort study. *BMJ Open*, 7(11), e018249.

<https://doi.org/10.1136/bmjopen-2017-018249>

Borhani, M., Sadeghi, R., Shojaeizadeh, D., Harandi, T. F., & Vakili, M. A. (2017). Teenage girls' experience of the determinants of physical activity promotion: A theory-based qualitative content analysis. *Electronic Physician*, 9(8), 5075–5082.

Brawley, L. R., & Latimer, A. E. (2007). Physical activity guides for Canadians: messaging strategies, realistic expectations for change, and evaluation. *Canadian Journal of Public Health*, 98 Suppl 2, S170-84. <https://doi.org/10.19082/5075>

Brennen, M., & Williams, C. (2013). Lifestyle Management of Cardiovascular Risk Factors in African American Women. *Lifestyle Management of Cardiovascular Risk Factors in African American Women*, 24(4).

Britton, H. (2017). What are community nurses experiences of assessing frailty and assisting in planning subsequent interventions? *British Journal of Community Nursing*, 22(9), 440–445. <https://doi.org/10.12968/bjcn.2017.22.9.440>

Bruno, R., Arnold, C., Jacobson, L., Winick, M., & Wynder, E. (1983). Randomized controlled trial of a nonpharmacologic cholesterol reduction program at the worksite. *Preventive Medicine*, 12(4), 523–532.

Buckley, J. (2016). Exercise self-efficacy intervention in overweight and obese women. *Journal of Health Psychology*, 21(6), 1074–1084. <https://doi.org/10.1177/1359105314545096>

Burke, L. E., Dunbar-Jacob, J. M., D., Hill, M. N. (1997). Compliance with cardiovascular disease prevention strategies: A review of the research. *Annals of Behavioural Medicine*, 19(3), 239-263.

- Burns, J. W., & Evon, D. (2007). Common and specific process factors in cardiac rehabilitation: Independent and interactive effects of the working alliance and self-efficacy. *Health Psychology, 26*(6), 684–692. <https://doi.org/10.1037/0278-6133.26.6.684>
- Buttar, S., Yan, T., Taggart, D., & Tian, D. (2017). Long-term and short-term outcomes of using bilateral internal mammary artery grafting versus left internal mammary artery grafting: A meta-analysis. *Heart, 103*(18), 1419. doi 10.1136/heartjnl-2016-310864
- Camarri, B., Eastwood, P., Cecins, N., Thompson, P., & Jenkins, S. (2006). Six minute walk test distance in healthy subjects aged 55-75 years. *Respiratory Medicine, 100* (4), 658-665. doi: 10.1016/j.rmed.2005.08.003
- Canadian Nurses Association. (2016). Clinical nurse specialist [Position statement]. Retrieved from <https://www.cna-aicc.ca/~media/cna/page-content/pdf-en/clinical-nurse-specialist-position-statement>
- Canadian Nurses Association. (2016). The nurse practitioner [Position statement]. Retrieved from <https://www.cna-aicc.ca/~media/cna/page-content/pdf-en/the-nurse-practitioner-position-statement>
- Canadian Society for Exercise Physiology. (2011). Canadian physical activity guidelines. Retrieved from [http://www.csep.ca/cmfiles/guidelines/csep\\_paguidelines\\_adults\\_en.pdf](http://www.csep.ca/cmfiles/guidelines/csep_paguidelines_adults_en.pdf)
- Carpenter, C. J. (2010). A meta-analysis of the effectiveness of health belief model variables in predicting behavior. *Health Communication, 25*(8), 661–669. <https://doi.org/10.1080/10410236.2010.521906>
- Casanova, C., Celli, B., Barria, P., Casas, A., Cote, C., de Torres, F.....Aguirre-Jaime, A. (2011). The 6-minute walk distance in healthy subjects: reference standards from seven countries.

*European Respiratory Journal*, 37(1), 150-156. doi: 10.1183/09031936.00194909.

Centers for Disease Control and Prevention. (2017). Heart disease facts. Retrieved from <https://www.cdc.gov/heartdisease/facts.htm>

Collard, R., Boter, H., Schoevers, R., & Voshaar, R. (2012). Prevalence of frailty in community dwelling older persons: a systematic review. *Journal of American Geriatric Society*, 60 (8), 1487-1492. doi: 10.1111/j.1532-5415.2012.04054.

Cilla, M., Peña, E., Martínez, M. A., & Kelly, D. J. (2013). Comparison of the vulnerability risk for positive versus negative atheroma plaque morphology. *Journal of Biomechanics*, 46(7), 1248–1254. <https://doi.org/10.1016/j.jbiomech.2013.02.012>

Chronic Disease Prevention and Promotion (2017). Heart disease and stroke. Retrieved from <https://www.cdc.gov/chronicdisease/resources/publications/aag/heart-disease-stroke.htm>

Cífková, R., & Krajčoviechová, A. (2015). Dyslipidemia and Cardiovascular Disease in Women. *Current Cardiology Reports*, 17(7), 1-10.

Clark, A. M., King-Shier, K. M., Spaling, M. A., Duncan, A. S., Stone, J. A., Jaglal, S. B., ... Angus, J. E. (2013). Factors influencing participation in cardiac rehabilitation programmes after referral and initial attendance: Qualitative systematic review and meta-synthesis. *Clinical Rehabilitation*, 27(10), 948–959. <https://doi.org/10.1177/0269215513481046>

Clark, D. (1996). Age, socioeconomic status, and exercise self-efficacy. *Gerontologist*, 36 (2), 157-164.

Clegg, A., Young, J., Illiffe, S., Rikkert, M., & Rockwood, K. (2013). Frailty in elderly people. *Lancet*, 381, (19868), 752-762. doi: 10.1016/S0140-6736(12) 62167-9.

Cohen, B., Hyman, S., Rosenberg, L., & Larson, E. (2012). Frequency of patient contact with

- health care personnel and visitors: Implications for infection prevention. *Joint Commission Journal on Quality and Patient Safety*, 38(12), 560–565. [https://doi.org/10.1016/S1553-7250\(12\)38073-2](https://doi.org/10.1016/S1553-7250(12)38073-2)
- Cohn, J. N., Hoke, L., Whitwam, W., Sommers, P. A., Taylor, A. L., Duprez, D., ... Florea, N. (2003). Screening for early detection of cardiovascular disease in asymptomatic individuals. *American Heart Journal*, 146(4), 679–685. [https://doi.org/10.1016/S0002-8703\(03\)00499](https://doi.org/10.1016/S0002-8703(03)00499)
- Cooney, G., Dwan, K., Greig, C., Lawlor, D., Rimer, J., Waugh, F., ... Mead, G. (2013). Exercise for depression. *Cochrane Database of Systematic Reviews*, (9), CD004366. <https://doi.org/10.1002/14651858.CD004366.pub6>
- Costanzo, C., & Walker, S. N. (2008). Incorporating self-efficacy and interpersonal support in an intervention to increase physical activity in older women. *Women and Health*, 47(4), 91–108. <https://doi.org/10.1080/03630240802100747>
- Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., ... Oja, P. (2003). International physical activity questionnaire: 12-Country reliability and validity. *Medicine and Science in Sports and Exercise*, 35(8), 1381–1395. <https://doi.org/10.1249/01.MSS.0000078924.61453.FB>
- Crapo, R. O., Casaburi, R., Coates, A. L., Enright, P. L., MacIntyre, N. R., McKay, R. T., ... Mottram, C. (2002). ATS statement: Guidelines for the six-minute walk test. *American Journal of Respiratory and Critical Care Medicine*, 166(1), 111–117. <https://doi.org/10.1164/rccm.166/1/111>
- Cupples, M. E., & McKnight, A. (1994). Randomised controlled trial of health promotion in general practice for patients at high cardiovascular risk. *BMJ (Clinical Research Ed.)*,

309(6960), 993–996.

D'Agostina, R., Vassan, R., Pencina, M., Wolf, P., Massaro, J., & Kannel, W. (2008). General cardiovascular risk profile for use in primary care: the Framingham heart study. *Circulation*, *117*(6), 743-753. doi: 10.1161/CIRCULATIONAHA.107.699579.

D'Angelo, M. E. S. D., Pelletier, L. G., Reid, R. D., & Huta, V. (2014). The roles of self-efficacy and motivation in the prediction of short- and long- term adherence to exercise among patients with coronary heart disease. *Health Psychol Ogy*, *33*(11), 1344–1353. <https://doi.org/http://dx.doi.org/10.1037/hea0000094>

da Silva Santos, A., Amaral Viana, M. C., Camelo Chaves, E. M., de Moraes Bezerra, A., Gonçalves Júnior, J., & Ribeiro Tamboril, A. C. (2018). Education technology based on Nola Pender: Promoting adolescent health. *Journal of Nursing UFPE*, *12*(2), 582–588. <https://doi.org/10.5205/1981-8963-v12i2a22609p582-588-2018>

Daley, L. K., Fish, A. F., Frid, D. J., & Mitchell, G. L. (2009). Stage-specific education/counselling intervention in women with elevated blood pressure. *Progress in Cardiovascular Nursing*, *24*(2), 45-52.

Daniali, S. S., Eslami, A. A., Maracy, M. R., Shahabi, J., & Mostafavi-Darani, F. (2017). The impact of educational intervention on self-care behaviors in overweight hypertensive women: a randomized control trial. *ARYA Atherosclerosis*, *13*(1), 20–28. Retrieved from <http://onlinelibrary.wiley.com/o/cochrane/clcentral/articles/552/CN-01372552/frame.html>

Darby, S. C., Ewertz, M., McGale, P., Bennet, A. M., Blom-Goldman, U., Brønnum, D., ... Hall, P. (2013). Risk of ischemic heart disease in women after radiotherapy for breast cancer. *New England Journal of Medicine*, *368*(11), 987–998.

<https://doi.org/10.1056/NEJMoa1209825>

Dawber, T. R., George, F. E., & Mann, V. (1957). Coronary heart disease in the Framingham study. *American Journal of Clinical Nutrition*, *47*, 4–24. <https://doi.org/10.1093/ije/dyv346>

Dawber, T. R., Meadors, G. F., & Moore, F. E. J. (1951). Epidemiological approaches to heart disease: The Framingham Study. *American Journal of Public Health and the Nation's Health*, *41*(3), 279–281.

de Araújo Gama, G., Soares Figueiredo Trezza, M. C., da Silva Rodrigues, P. M., & de Melo Cezar Alves, K. (2016). Health promotion in pregnancy: Enforcement of Nola Pender theory on prenatal care. *Journal of Nursing UFPE / Revista de Enfermagem UFPE*, *10*, 4428–4431. <https://doi.org/10.5205/reuol.9284-81146-1-SM.1005sup201638>

Delecluse, C., Colman, V., Roelants, M., Verschueren, S., Derave, W., Ceux, T., ... Stijnen, V. (2004). Exercise programs for older men: mode and intensity to induce the highest possible health-related benefits. *Preventive Medicine*, *39*(4), 823–833. <https://doi.org/10.1016/j.ypmed.2004.03.023>

Devore, S. R., Indelicato, N. A., Alnojeidi, A. H., Richardson, M. R., Boyer, W. R., Johnson, T. M., & Churilla, J. R. (2014). Associations between severity of mental distress, high cholesterol, and physical activity in U.S. adults. *Medicine and Science in Sports and Exercise*, *46*(5), 771.

Dhingra, R., & Vasan, R. S. (2012). Age as a risk factor. *Medical Clinics of North America*, *96*(1), 87–91. <https://doi.org/10.1016/j.mcna.2011.11.003>

Doba, N., Tokuda, Y., Saiki, K., Kushiro, T., Hirano, M., Matsubara, Y., & Hinohara, S. (2016). Assessment of Self-Efficacy and its Relationship with Frailty in the Elderly. *Internal*

*Medicine*, 55(19), 2785–2792. <https://doi.org/10.2169/internalmedicine.55.6924>

Dohnke, B., Nowossadeck, E., & Müller-Fahrnow, W. (2010). Motivation and participation in a phase III cardiac rehabilitation programme: An application of the health action process approach. *Research in Sports Medicine*, 18(4), 219–235.  
<https://doi.org/10.1080/15438627.2010.510032>

Dolansky, M. A., Stepanczuk, B., Charvat, J. M., & Moore, S. M. (2010). Women's and men's exercise adherence after a cardiac event. *Research in Gerontological Nursing*, 3(1), 30–38.  
<https://doi.org/10.3928/19404921-20090706-03>

Dolansky, M. A., Zullo, M. D., Boxer, R. S., & Moore, S. M. (2011). Initial efficacy of a cardiac rehabilitation transition program: Cardiac TRUST.(cardiac transitional rehabilitation using self-management techniques). *Journal of Gerontological Nursing*, 37(12), 36-44.

Doll, R., & Hill, A. B. (1956). Lung cancer and other causes of death in relation to smoking: A second report on the mortality of british doctors. *British Medical Journal*, 2(5001), 1071–81. <https://doi.org/10.1136/bmj.2.5001.1071>

Dudina, A., Cooney, M. T., Bacquer, D. De, Backer, G. De, Ducimetiere, P., Jousilahti, P., ... Graham, I. (2011). Relationships between body mass index, cardiovascular mortality, and risk factors: a report from the SCORE investigators. *European Journal of Cardiovascular Prevention and Rehabilitation*, 18(5), 731–742. <https://doi.org/10.1177/1741826711412039>

Duncan, L. R., Rodgers, W. M., Hall, C. R., & Wilson, P. M. (2011). Using imagery to enhance three types of exercise self-efficacy among sedentary women. *Applied Psychology: Health and Well-Being*, 3(1), 107–126. <https://doi.org/10.1111/j.1758-0854.2010.01043.x>

Duprez, D. A., Florea, N., Zhong, W., Grandits, G. A., Hawthorne, C. K., Hoke, L., & Cohn, J.

- N. (2011). Vascular and cardiac functional and structural screening to identify risk of future morbid events: Preliminary observations. *Journal of the American Society of Hypertension*, 5(5), 401–409. <https://doi.org/10.1016/j.jash.2011.05.001>
- Ebstrup, J. F., Aadahl, M., Eplöv, L. F., Pisinger, C., & Jørgensen, T. (2013). Cross-sectional associations between the five factor personality traits and leisure-time sitting-time: The effect of general self-efficacy. *Journal of Physical Activity & Health*, 10, 572–580. <https://doi.org/10.3868/s110-003-014-0039-x>
- Edwards, E. S., & Sackett, S. C. (2016). Psychosocial variables related to why women are less active than men and related health implications. *Clinical Medicine Insights. Women's Health*, 9(Suppl 1), 47–56. <https://doi.org/10.4137/CMWH.S34668>
- Ekkekakis, P. (2013). *Routledge handbook of physical activity and mental health*. Routledge. <https://doi.org/10.4324/9780203132678>
- Elime, R., Harvey, J., Charity, M, Casey, M., van Uffelen, J., & Payne, W. (2015). The contribution of sport participation to overall health enhancing physical activity levels in Austria: a population-based study. *BioMed Central Public Health*, 15, 806. doi: 10.1186/s12889-015-2156-9.
- Elisha, B., Rabasa-Lhoret, R., Messier, V., Abdunour, J., & Karelis, A. D. (2013). Relationship between the body adiposity index and cardiometabolic risk factors in obese postmenopausal women. *European Journal of Nutrition*, 52(1), 145–151. <https://doi.org/10.1007/s00394-011-0296-y>
- Emberson, J., Whincup, P., Morris, R., Walker, M., & Ebrahim, S. (2004). Evaluating the impact of population and high-risk strategies for the primary prevention of cardiovascular disease.

*European Heart Journal*, 25(6), 484–491. <https://doi.org/10.1016/j.ehj.2003.11.012>

Emmen, M. J., Peters, E., Elving, L. D., Bredie, S. J. H., Wollersheim, H., Bleijenberg, G., & Schippers, G. M. (2006). A brief behavioral feedback intervention in hospital outpatients with a high cardiovascular risk. *Patient Education and Counseling*, 60(1), 32–40. <https://doi.org/10.1016/j.pec.2004.11.011>

Ersin, F., & Bahar, Z. (2017). Effects of nursing interventions planned with the health promotion models on the breast and cervical cancer early detection behaviors of the women. *International Journal of Caring Sciences*, 10(1), 421–432

Ewart, C. K., Harris, W. L., Iwata, M. M., Coates, T. J., Bullock, R., & Simon, B. (1987). Feasibility and effectiveness of school-based relaxation in lowering blood pressure. *Health Psychology*, 6(5), 399–416.

Fairhall, N., Langrong, C., Sherrington, C., Lord, S., Kurrie, S., Lockwood, K.,...Cameron, I. (2011). Treating frailty-a practical guide. *Biomed Central Medicine*, 9, 83. [doi:10.1186/1741-7015-9-83](https://doi.org/10.1186/1741-7015-9-83).

Fanning, J., Walkup, M. P., Ambrosius, W. T., Brawley, L. R., Ip, E. H., Marsh, A. P., & Rejeski, W. J. (2017). Change in health-related quality of life and social cognitive outcomes in obese, older adults in a randomized controlled weight loss trial: Does physical activity behavior matter? *Journal of Behavioral Medicine*, 1–10. <https://doi.org/10.1007/s10865-017-9903-6>

Faulkner, J., Westrupp, N., Rousseau, J., & Lark, S. (2013). A randomized controlled trial to assess the effect of self-paced walking on task-specific anxiety in cardiac rehabilitation patients. *Journal of Cardiopulmonary Rehabilitation and Prevention*, 33(5), 292–296.

<https://doi.org/10.1097/HCR.0b013e3182a0295c>

Fishbein, M. (1975). *Belief, attitude, intention and behavior : An introduction to theory and research*. (I. Ajzen, Ed.). Reading, Mass.: Reading, MA : Addison-Wesley Pub. Co.

Flay, B. R., Gruder, C. L., Warnecke, R. B., Jason, L. A., & Peterson, P. (1989). One year follow-up of the Chicago televised smoking cessation program. *American Journal of Public Health, 79*(10), 1377–1380.

Flora, P. K., Anderson, T. J., & Brawley, L. R. (2015). Illness perceptions and adherence to exercise therapy in cardiac rehabilitation participants. *Rehabilitation Psychology, 60*(2), 179–186. <https://doi.org/10.1037/a0039123>

Frank, A. M., McConnell, T. R., Rawson, E. S., & Fradkin, A. (2011). Clinical and functional predictors of health-related quality of life during cardiac rehabilitation. *Journal of Cardiopulmonary Rehabilitation and Prevention, 31*(4), 223–229.  
<https://doi.org/10.1097/HCR.0b013e31820333b3>

Fraser, S. N., & Rodgers, W. M. (2010). An examination of psychosocial correlates of exercise tolerance in cardiac rehabilitation participants. *Journal of Behavioral Medicine, 33*(2), 159–167. <https://doi.org/10.1007/s10865-009-9240-5>

Fried, L. P., Tangen, C. M., Walston, J., Newman, A. B., Hirsch, C., Gottdiener, J., ... Mcburnie, M. A. (2001). Frailty in Older Adults: Evidence for a Phenotype. *Journal of Gerontology: Medical sciences America, 56*(3), 146–156. <https://doi.org/10.1093/gerona/56.3.M146>

Furukawa, F., Kazuma, K., Kawa, M., Miyashita, M., Niino, K., Kusukawa, R., & Kojima, M. (2003). Effects of an off-site walking program on energy expenditure, serum lipids, and glucose metabolism in middle-aged women. *Biological Research for Nursing, 4*(3), 181–

192. <https://doi.org/10.1177/1099800402239623>

Galbraith, E. M., Mehta, P. K., Veledar, E., Vaccarino, V., & Wenger, N. K. (2011). Women and heart disease: knowledge, worry, and motivation. *Journal of Women's Health (15409996)*, 20(10), 1529–1534. <https://doi.org/10.1089/jwh.2010.2356>

Gallagher, N. A., Clarke, P. J., & Gretebeck, K. A. (2014). Gender differences in neighborhood walking in older adults. *Journal of Aging and Health*, 26(8), 1280–1300. <https://doi.org/10.1177/0898264314532686>

Gammage, K. L., & Klentrou, P. (2011). Behaviors : Health beliefs and knowledge. *American Journal of Health Behaviour*, 35(3), 371–383.

Garcia, M., Mulvagh, S. L., Merz, C. N. B., Buring, J. E., & Manson, J. E. (2016). Cardiovascular disease in women: Clinical perspectives. *Circulation Research*, 118(8), 1273–1293. <https://doi.org/10.1161/CIRCRESAHA.116.307547>

Gell, N. M., & Wadsworth, D. D. (2015). The use of text messaging to promote physical activity in working women: A randomized controlled trial. *Journal of Physical Activity and Health*, 12(6), 756–763. <https://doi.org/10.1123/jpah.2013-0144>

Ghisi, G. L. de M., Grace, S. L., Thomas, S., & Oh, P. (2015). Behavior determinants among cardiac rehabilitation patients receiving educational interventions: An application of the health action process approach. *Patient Education and Counseling*, 98(5), 612–621. <https://doi.org/10.1016/j.pec.2015.01.006>

Glanz, K., Rimer, B., & Lewis, F. (Eds.). (2008). *Health behavior and health education : Theory, research, and practice* (4th ed.). San Francisco, CA: Jossey-Bass.

Gomel, M., Oldenburg, B., Simpson, J. M., & Owen, N. (1993). Work-site cardiovascular risk

reduction: a randomized trial of health risk assessment, education, counseling, and incentives. *American Journal of Public Health*, 83(9), 1231–1238.

Gothe, N. P., & Kendall, B. J. (2016). Barriers, motivations, and preferences for physical activity among female African American older adults. *Gerontology and Geriatric Medicine*, 2, 1-8.  
<https://doi.org/10.1177/2333721416677399>

Gouvernement of Canada. (2015). Chart 1. Adult obesity prevalence in Canada and the United States. Retrieved from <https://www150.statcan.gc.ca/n1/pub/82-625-x/2011001/article/11411-eng.htm>

Gouvernement of Canada. (2010). Table 2. Percentage distribution of frail seniors, based on Frailty Index cut-point of >0.21, by age group, sex, and province/territory, household population, Canada, 2009/2010. Retrieved from: <https://www150.statcan.gc.ca/n1/pub/82-003-x/2013009/article/11864/tbl/tbl2-eng.htm>

Gouvernement of Canada. (2017). Heart disease in Canada: Highlights from the Canadian chronic disease surveillance system. Retrieved from <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/heart-disease-canada-fact-sheet.html>

Grady, D., Chaput, L., & Kristof, M. (2003). Results of Systematic Review of Research on Diagnosis and Treatment of Coronary Heart Disease in Women. (2003). Agency for Healthcare Research and Quality (US).

Grover, S., Coupal, L., Kaouache, M., & Lowensteyn, I. (2007). Preventing cardiovascular disease among Canadians: what are the potential benefits of treating hypertension or dyslipidemia? *The Canadian Journal of Cardiology*, 23(6), 467–473.  
[https://doi.org/10.1016/S0828-282X\(07\)70786-9](https://doi.org/10.1016/S0828-282X(07)70786-9)

- Gusi, N., Reyes, M. C., Gonzalez-Guerrero, J. L., Herrera, E., & Garcia, J. M. (2008). Cost-utility of a walking programme for moderately depressed, obese, or overweight elderly women in primary care: a randomised controlled trial. *BMC Public Health*, 8, 231. <https://doi.org/10.1186/1471-2458-8-231>
- Hackstaff, L., (2009). Factors associated with frailty in chronically ill older adults. *Social Work in Health Care*, 48(8), 798-811. <https://doi.org/10.1080/00981380903327897>
- Haines, A., Patterson, D., Rayner, M., & Hyland, K. (1992). Prevention of cardiovascular disease. *Occasional Paper (Royal College of General Practitioners)*, (58), 67–78. <https://doi.org/10.1001/jama.2011.1668>
- Haley, W. E., Roth, D. L., Howard, G., & Safford, M. M. (2010). Caregiving strain and estimated risk for stroke and coronary heart disease among spouse caregivers: Differential effects by race and sex. *Stroke*, 41(2), 331–336. <https://doi.org/10.1161/STROKEAHA.109.568279>
- Hallam, K. T., Bilsborough, S., & de Courten, M. (2018). “Happy feet”: Evaluating the benefits of a 100-day 10,000 step challenge on mental health and wellbeing. *BMC Psychiatry*, 18(1), 1–7. <https://doi.org/10.1186/s12888-018-1609-y>
- Hankinson, A. L., Daviglius, M. L., Bouchard, C., Carnethon, M., Lewis, C. E., Schreiner, P. J., ... Sidney, S. (2010). Maintaining a high physical activity level over 20 years and weight gain. *JAMA*, 304(23), 2603–2610. <https://doi.org/10.1001/jama.2010.1843>
- Harrison, J. A., Mullen, P. D., & Green, L. W. (1992). A meta-analysis of studies of the health belief model with adults. *Health Education Research*, 7(1), 107–116. <https://doi.org/10.1093/her/7.1.107>

- Hayashi, T., Farrell, M. A., Chaput, L. A., Rocha, D. A., & Hernandez, M. (2010). Lifestyle intervention, behavioral changes, and improvement in cardiovascular risk profiles in the California WISEWOMAN project. *Journal of Women's Health (2002)*, *19*(6), 1129–1138. <https://doi.org/10.1089/jwh.2009.1631>
- Hayden, J. (2009). *Introduction to health behavior theory*. Sudbury, MA: Jones and Bartlett.
- Hays, L. M., & Clark, D. O. (1999). Correlates of physical activity in a sample of older adults with type 2 diabetes. *Diabetes Care*, *22*(5), 706–12. <https://doi.org/10.2337/diacare.22.5.706>
- Hays, L. M., Pressler, S. J., Damush, T. M., Rawl, S. M., & Clark, D. O. (2010). Exercise adoption among older, low-income women at risk for cardiovascular disease. *Public Health Nursing*, *27*(1), 79–88. <https://doi.org/10.1111/j.1525-1446.2009.00829.x>
- Heart and Stroke Foundation (2016). The burden of heart failure. Retrieved from <https://www.heartandstroke.ca/-/media/pdf-files/canada/2017-heart-month/heartandstroke-reportonhealth-2016>
- Heart and Stroke Foundation (2017). Heart: Risk and Prevention. Retrieved from <http://www.heartandstroke.ca/heart/risk-and-prevention>
- Heart and Stroke Foundation (2018). Women's unique risk factors. Retrieved from <http://www.heartandstroke.ca/heart/risk-and-prevention/womens-unique-risk-factors>
- Heart Research Institute (2017). Facts about heart disease. Retrieved from <http://www.hricanada.org/about-heart-disease/facts-about-heart-disease>
- Herr, M., Robine, J., Aegerter, P., Ariveu, J., & Ankri, J. (2015). Contribution of socioeconomic position over life to frailty differences in old age: comparison of life-course models in a

french sample of 2350 old people. *Annals of Epidemiology*, 25(9), 674-680. doi:  
10.1016/j.annepidem.2015.05.006

Hesketh, K. R., O'Malley, C., Paes, V. M., Moore, H., Summerbell, C., Ong, K. K., ... van Sluijs, E. M. F. (2017). Determinants of change in physical activity in children 0–6 years of age: A systematic review of quantitative literature. *Sports Medicine*, 47(7), 1349–1374.  
<https://doi.org/10.1007/s40279-016-0656-0>

Higgins, T. J., Middleton, K. R., Winner, L., & Janelle, C. M. (2014). Physical activity interventions differentially affect exercise task and barrier self-efficacy: A meta-analysis. *Health Psychology*, 33(8), 891–903. <https://doi.org/10.1037/a0033864>

Holt-Lundstad, J. & Smith, T. (2015). Loneliness and social isolation as risk factors for CVD: implications for evidence-based patient care and scientific inquiry. *Heart*, 2016; 1-3. doi.  
10.1136/heartjnl-2015-309242

Hörnberg, K., Sundström, B., Innala, L., Rantapää-Dahlqvist, S., & Wållberg-Jonsson, S. (2017). Aerobic capacity over 16 years in patients with rheumatoid arthritis: Relationship to disease activity and risk factors for cardiovascular disease. *Plos One*, 12(12), e0190211.  
<https://doi.org/10.1371/journal.pone.0190211>

Howarter, A. D., Bennett, K. K., Barber, C. E., Gessner, S. N., & Clark, J. M. R. (2014). Exercise Self-efficacy and Symptoms of Depression After Cardiac Rehabilitation. *The Journal of Cardiovascular Nursing*, 29(2), 168–177.  
<https://doi.org/10.1097/JCN.0b013e318282c8d6>

Hsu, A., & Wong, R. (2017). Cardiovascular health awareness and promotion in women: AHA's life's simple 7™ and go red for women™. *Current Cardiovascular Risk Reports*, 11(4), 1-8

- Hubbard, R., Lang, I., Llewellyn, D., & Rockwood, K. (2010). Frailty, body mass index, and abdominal obesity in older adults. *Journal of Gerontology*, *65*(4), 377-381. doi: 10.1093/geron/glp186
- Huffman, J. C., Celano, C. M., Beach, S. R., Motiwala, S. R., & Januzzi, J. L. (2013). Depression and cardiac disease: Epidemiology, mechanisms, and diagnosis. *Cardiovascular Psychiatry and Neurology*, 2013. <https://doi.org/10.1155/2013/695925>
- Hulley, S., Grady, D., Bush, T., & Furberg, C. (1998). Randomized trial of estrogen plus progestin for secondary prevention of coronary heart disease in postmenopausal women. *JAMA*, *280*(7), 605-13.
- Husser, E. K., & Roberto, K. A. (2009). Older women with cardiovascular disease: Perceptions of initial experiences and long-term influences on daily life. *Journal of Women and Aging*, *21*(1), 3-18. <https://doi.org/10.1080/08952840802633529>
- Jacobs, A. D., Ammerman, A. S., Ennett, S. T., Campbell, M. K., Tawney, K. W., Aytur, S. A., ... Rosamond, W. D. (2004). Effects of a tailored follow-up intervention on health behaviors, beliefs, and attitudes. *Journal of Women's Health* (2002), *13*(5), 557-568. <https://doi.org/10.1089/1540999041281016>
- Jacobs, D., Mebane, I., Bangdiwala, S., Criqui, M., & Tyroler, H. (1990). High density lipoprotein cholesterol as a predictor of cardiovascular disease mortality in men and women: The follow-up study of the lipid research clinics prevalence study. *American Journal of Epidemiology*, *131*(1), 32-47.
- Jiang, M., Foebel, A., Kuju-Halkola, R., Karlson, I., Pedersen, N., Hagg, S., & Jylhava, J. (2017). *Aging*, *9* (12), 2629-2646. doi: 10.18632/aging.101352.

- Janssen, I., Dugan, S. A., Karavolos, K., Lynch, E. B., & Powell, L. H. (2014). Correlates of 15-year maintenance of physical activity in middle-aged women. *International Journal of Behavioral Medicine, 21*(3), 511–518. <https://doi.org/10.1007/s12529-013-9324-z>
- Janz, & Becker, M. H. (1984). The health belief model: A decade later. *Health Education Quarterly, 11*(1), 1–47.
- Jerome, G. J., & McAuley, E. (2013). Enrollment and participation in a pilot walking programme: The role of self-efficacy. *Journal of Health Psychology, 18*(2), 236–244. <https://doi.org/10.1177/1359105311430869>
- Jerusalem, M., & Schwarzer, R. (1992). Self-efficacy as a resource factor in stress appraisal processes. In R. Schwarzer (Ed.), *Self-efficacy: Thought control of action* (pp. 195-213). Washington, DC: Hemisphere.
- Johansson, M., Hartig, T., & Staats, H. (2011). Psychological benefits of walking: Moderation by company and outdoor environment. *Applied Psychology: Health and Well-Being, 3*(3), 261–280. <https://doi.org/10.1111/j.1758-0854.2011.01051.x>
- Jones, D. S. (2013). The DECLINE and RISE of CORONARY HEART DISEASE. *American Journal of Public Health, 103*(7), 1–13. <https://doi.org/10.2105/AJPH.2013.301226>.
- Josefsson, T., Lindwall, M., & Archer, T. (2014). Physical exercise intervention in depressive disorders: Meta-analysis and systematic review. *Scandinavian Journal of Medicine and Science in Sports, 24*(2), 259–272. <https://doi.org/10.1111/sms.12050>
- Joseph, R. P., Ainsworth, B. E., Mathis, L., Hooker, S. P., & Keller, C. (2017). Utility of social cognitive theory in intervention design for promoting physical activity among African-American women: A qualitative study. *American Journal of Health Behavior, 41*(5), 518–

533. <https://doi.org/10.5993/AJHB.41.5.1>

Juniper, K., Oman, R., Hamm, R., & Kerby, D. (2004). The relationships among constructs in the health belief model and the transtheoretical model among African-American college women for physical activity. *American Journal of Health Promotion, 18*(5), 354-357.

Jurschik, P., Nunin, C., Botigue, T., Escobar, M., Lavedan, A., & Viladrosa, M. (2012). Prevalence of frailty and factors associated with frailty in the elderly population of Lleida, Spain: the FRALLE survey. *Archives of Gerontology and Geriatrics, 55*(3), 625-631. doi: 10.1016/j.archger.2012.07.002

Kahng, S., Dunkle R., & Jackson, J. (2004). The relationship between the trajectory of body mass index and health trajectory multilevel modeling analyses. *Research on Aging, 26*, 31-61.

Kang, Y., & Yang, I. S. (2013). Cardiac self-efficacy and its predictors in patients with coronary artery diseases. *Journal of Clinical Nursing, 22*(17-18), 2465-2473. <https://doi.org/10.1111/jocn.12142>

Katzmarzyk, P. T., Reeder, B. A., Elliott, S., Joffres, M. R., Pahwa, P., Raine, K. D., ... Paradis, G. (2012). Body mass index and risk of cardiovascular disease, cancer and all-cause mortality. *Canadian Journal of Public Health, 103*(2), 147-151.

Kaushal, N., & Rhodes, R. E. (2015). Exercise habit formation in new gym members: a longitudinal study. *Journal of Behavioral Medicine, 38*(4), 652-663. <https://doi.org/10.1007/s10865-015-9640-7>

Kawamoto, K. R., Davis, M. B., & Duvernoy, C. S. (2016). Acute coronary syndromes: Differences in men and women. *Current Atherosclerosis Reports, 18*(12).

<https://doi.org/10.1007/s11883-016-0629-7>

Kehler, D., Ferguson, T., Stammers, A., Bohm, C., Arora, E., Duhamel, T., & Tangri, N. (2017).

Prevalence of frailty in Canadians 18-79 years old in Canadian Health Measures Survey.

*Biomedical Central Geriatrics*, 17 (28). doi: 10/1186s12877-017-0423-6

Kessous, R., Shoham-Vardi, I., Pariente, G., Holcberg, G., & Sheiner, E. (2013). An association

between preterm delivery and long-term maternal cardiovascular morbidity. *American*

*Journal of Obstetrics and Gynecology*, 209(4), 368.e1-368.e8.

<https://doi.org/10.1016/j.ajog.2013.05.041>

Keys, A., Aravanis, C., Blackburn, H. W., Van Buchem, F. S., Buzina, R., Djordjevic, B. D., ...

Taylor, H. L. (1966). Epidemiological studies related to coronary heart disease:

Characteristics of men aged 40-59 in seven countries. *Acta Medica Scandinavica*.

*Supplementum*, 460, 1-392.

Khodaveisi, M., Omid, A., Farokhi, S., & Soltanian, A. R. (2017). The effect of pender's health

promotion model in improving the nutritional behavior of overweight and obese women.

*International Journal of Community Based Nursing and Midwifery*, 5(2), 165-174.

Killen, J. D., Taylor, C. B., Hammer, L. D., Litt, I., Wilson, D. M., Rich, T., ... Varady, A.

(1993). An attempt to modify unhealthy eating attitudes and weight regulation practices of

young adolescent girls. *The International Journal of Eating Disorders*, 13(4), 369-384.

King, A. C., Taylor, C. B., Haskell, W. L., & DeBusk, R. F. (1989). Influence of regular aerobic

exercise on psychological health: A randomized, controlled trial of healthy middle-aged

adults. *Health Psychology*, 8(3), 305-324. <https://doi.org/10.1037/0278-6133.8.3.305>

Kjønniksen, L., Anderssen, N., & Wold, B. (2009). Organized youth sport as a predictor of

physical activity in adulthood. *Scandinavian Journal of Medicine and Science in Sports*, 19(5), 646–654. <https://doi.org/10.1111/j.1600-0838.2008.00850.x>

Kling, J. M., Miller, V. M., Mankad, R., Wilansky, S., Wu, Q., Zais, T. G., ... Mulvagh, S. L. (2013). Go red for women cardiovascular health—screening evaluation: The dichotomy between awareness and perception of cardiovascular risk in the community. *Journal of Women's Health*, 22(3), 210–218. <https://doi.org/10.1089/jwh.2012.3744>

Knowler, W., Fowler, S., Hamman, R., Lachin, J., Walker, E., & Nathan, D. (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *New England Journal of Medicine*, 346(6), 393–403. <https://doi.org/10.1056/NEJMoa012512>

Knox, E. C. L., Webb, O. J., Esliger, D. W., Biddle, S. J. H., & Sherar, L. B. (2014). Using threshold messages to promote physical activity: implications for public perceptions of health effects. *European Journal of Public Health*, 24(2), 195–199. <http://dx.doi.org/10.1093/eurpub/ckt060>

Kohl, H. W. (2001). Physical activity and cardiovascular disease: evidence for a dose response. *Medicine and Science in Sports and Exercise*, 33(6 Suppl), S472–NaN–S494. <https://doi.org/10.1097/00005768-200106001-00017>

Kosteli, M. C., Cumming, J., & Williams, S. E. (2018). Self-regulatory imagery and physical activity in middle-aged and older adults: A social-cognitive perspective. *Journal of Aging and Physical Activity*, 26(1), 14–24. <https://doi.org/10.1123/japa.2016-0024>

Kowall, B., Rathmann, W., Stang, A., Bongaerts, B., Kuss, O., Herder, C., . . . Meisinger, C. (2017). Perceived risk of diabetes seriously underestimates actual diabetes risk: The KORA FF4 study. *PloS One*, 12(1), E0171152.

Kupst, M., Butt, Z., Stoney, C., Griffith, J., Salsman, J., Folkman, S., & Cella, D.

(2015). Assessment of stress and self-efficacy for the NIH Toolbox for Neurological and Behavioral Function, Anxiety, *Stress & Coping*, 28:5, 531-544, DOI: 10.1080/10615806.2014.994204

Larsen, B. A., Strong, D., & Linke, S. E. (2014). The association between family and friend integration and physical activity: results from the NHIS. *International Journal of Behavioral Medicine*, 21(3), 529–536. <https://doi.org/10.1007/s12529-013-9318-x>

Lavie, C., DeSchutter, A., Milani, R. (2015). Healthy obese versus unhealthy lean: the obesity paradox. *Nature Reviews Endocrinology*, 11(1), 55-62. doi: 10.1038/nrendo.2014.165

Lear, S. & Yusuf, S. (2017). Physical activity to prevent cardiovascular disease: a simple, low-cost, and widely applicable approach for all populations. *Journal of American Medical Association: Cardiology*, 2(12), 1358-1360. doi: 10.1001/jamacardio.2017.4070.

Leo, D., & Teo, K. (2015). Predicting cardiovascular disease from handgrip strength: the potential clinical implications. *Expert Review of Cardiovascular Therapy*, 13 (12), 1277-1279. doi: 10.1586/14779072.2015.1101342

Lewin, K. (1938). *The conceptual representation and the measurement of psychological forces*. Durham, N.C: Duke University Press.

Lim, P., Shiels, P., Anderson, J., & MacDonald, T. (1999). Dundee step test: a simple method of measuring the blood pressure response to exercise. *Journal of Human Hypertension*, 13(8), 521–526.

Lima, M. C. S., Barbosa, M. F., Diniz, T. A., Codogno, J. S., Freitas Júnior, I. F., & Fernandes,

- R. A. (2014). Early and current physical activity: Relationship with intima-media thickness and metabolic variables in adulthood. *Brazilian Journal of Physical Therapy*, *18*(5), 462–469. <https://doi.org/10.1590/bjpt-rbf.2014.0040>
- Lindsay Smith, G., Banting, L., Eime, R., O’Sullivan, G., & van Uffelen, J. G. Z. (2017). The association between social support and physical activity in older adults: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, *14*(1), 1–21. <https://doi.org/10.1186/s12966-017-0509-8>
- Lizcano, F., & Guzmán, G. (2014). Estrogen deficiency and the origin of obesity during menopause. *BioMed Research International*, *2014*. <https://doi.org/10.1155/2014/757461>
- Ljung, S., Olsson, C., Rask, M., & Lindahl, B. (2013). Patient experiences of a theory-based lifestyle-focused group treatment in the prevention of cardiovascular diseases and type 2 diabetes. *International Journal of Behavioral Medicine*, *20*(3), 378–384. <https://doi.org/10.1007/s12529-012-9252-3>
- Lowe, J. B., Windsor, R. A., & Post, K. L. (1987). Effectiveness of impersonal versus interpersonal methods to recruit employees into worksite quit smoking programs. *Addictive Behaviors*, *12*, 281–284.
- Luszczynska, A., Scholz, U., & Schwarzer, R. (2005). The general self-efficacy scale: Multicultural validation studies. *Journal of Psychology: Interdisciplinary and Applied*, *139*(5), 439–457. <https://doi.org/10.3200/JRLP.139.5.439-457>
- McLaughlin GH. SMOG grading-a new readability formula. *J Reading*. 1969;12(8):639–46.
- Maas, A. H. E. M., & Appelman, Y. E. A. (2010). Gender differences in coronary heart disease.

*Netherlands Heart Journal* , 18(12), 598–602. <https://doi.org/10.1007/s12471-010-0841->

[y](#)

- Madsen, K. A., McCulloch, C. E., & Crawford, P. B. (2009). Parent modeling: Perceptions of parents' physical activity predict girls' activity throughout adolescence. *Journal of Pediatrics*, 154(2). <https://doi.org/10.1016/j.jpeds.2008.07.044>
- Mahmood, Levy, Vasan, & Wang. (2014). The Framingham Heart Study and the epidemiology of cardiovascular disease: A historical perspective. *The Lancet*, 383(9921), 999-1008.
- Malecki-Ketchell, A. (2017). Pathophysiology , assessment and treatment of coronary heart disease in women, 31(40), 51–61. doi: 10.7748/ns.2017.e10818
- Manson, J. E., Greenland, P., LaCroix, A. Z., Stefanick, M. L., Mouton, C. P., Oberman, A., ... Siscovick, D. S. (2002). Walking compared with vigorous exercise for the prevention of cardiovascular events in women. *New England Journal Medicine*, 347(10), 716–725.
- Maron, D. J., Forbes, B. L., Groves, J. R., Dietrich, M. S., Sells, P., & DiGenio, A. G. (2008). Health-risk appraisal with or without disease management for worksite cardiovascular risk reduction. *The Journal of Cardiovascular Nursing*, 23(6), 513–518. <https://doi.org/10.1097/01.JCN.0000338933.81587.b4>
- Maruf, F. A., Ojukwu, C. C., & Akindele, M. O. (2017). Perception, knowledge, and attitude toward physical activity behaviour: Implications for participation among individuals with essential hypertension. *High blood pressure & cardiovascular prevention* 25(1), 53-61. <https://doi.org/10.1007/s40292-017-0235-y>
- Mason, R. C., Horvat, M., & Nocera, J. (2016). The effects of exercise on the physical fitness of high and moderate-low functioning older adult women. *Journal of Aging Research*, 2016, 1-

7 <https://doi.org/10.1155/2016/8309284>

Masters, K. (2015). *Nursing theories : A framework for professional practice* (2<sup>nd</sup> ed.).

Burlington, MA. : Jones & Bartlett Learning.

Matsuda, P. N., Shumway-Cook, A., & Ciol, M. (2010). The effects of a home-based exercise program on physical function in frail older adults. *Journal of Geriatric Physical Therapy* (2001), 33(2), 78-84. <https://doi.org/10.1097/JPT.0b013e3181deff9e>

Maxwell, C., & Wang, J. (2017). Understanding frailty: a nurse's guide. *Nurse Clinicians of North America*, 52(3), 349-361. doi: 10.1016/j.cnur.2017.04.003.

Mayer, J. A., Jermanovich, A., Wright, B. L., Elder, J. P., Drew, J. A., & Williams, S. J. (1994). Changes in health behaviors of older adults: the San Diego medicare preventive health project. *Preventive Medicine*, 23(2), 127–133. <https://doi.org/10.1006/pmed.1994.1018>

McArthur, D., Dumas, A., Woodend, K., Beach, S., & Stacey, D. (2014). Factors influencing adherence to regular exercise in middle-aged women: a qualitative study to inform clinical practice. *BMC Women's Health*, 14(1), 49. <https://doi.org/10.1186/1472-6874-14-49>

McAuley, E. (1992). The role of efficacy cognitions in the prediction of exercise behavior in middle-aged adults. *Journal of Behavioral Medicine*, 15(1), 65–88.

<https://doi.org/10.1007/BF00848378>

McAuley, E. (1993). Self-efficacy and the maintainance of exercise participation in older adults. *Journal of Behavioral Medicine*, 16(1), 103–113.

McEwen, M. (2011). *Theoretical basis for nursing*. (E. M. Wills & M. McEwen, Eds.) (3rd ed.). Philadelphia: PA : Wolters Kluwer/Lippincott Williams & Wilkins.

McIntosh, T., Hunter, D. J., & Royce, S. (2016). Barriers to physical activity in obese adults: A

rapid evidence assessment. *Journal of Research in Nursing*, 21(4), 271–287.

<https://doi.org/10.1177/1744987116647762>

Mehta, L. S., Beckie, T. M., DeVon, H. A., Grines, C. L., Krumholz, H. M., Johnson, M. N., ...

Wenger, N. K. (2016). Acute myocardial infarction in women : A scientific statement from the American heart association. *Circulation* 2016 (133), 916-947.

<https://doi.org/10.1161/CIR.0000000000000351>

Mendis S, Puska P, & Norrving, B. (2011). Global Atlas on cardiovascular disease prevention and control. *World Health Organization*. Retrieved from

[http://www.who.int/cardiovascular\\_diseases/publications/atlas\\_cvd/en/](http://www.who.int/cardiovascular_diseases/publications/atlas_cvd/en/)

Mensah, G. A., Wei, G. S., Sorlie, P. D., Fine, L. J., Rosenberg, Y., Kaufmann, P. G., ...

Gordon, D. (2017). Decline in cardiovascular mortality: possible causes and implications. *Circulation Research*, 120(2), 366–380.

<https://doi.org/10.1161/CIRCRESAHA.116.309115>

Mezuk, B., Lohman, M., Rock, A., & Payne, M. (2016). Trajectories of body mass indices and development of frailty: evidence from the health and retirement study. *Obesity*, 24(8), 1643-1647. doi: 10.1002/oby.21572.

Miao, M., Gan, Y., Gan, T., & Zhou, G. (2017). Carry-over effect between diet and physical activity: the bottom-up and top-down hypotheses of hierarchical self-efficacy. *Psychology, Health and Medicine*, 22(3), 266–274. <https://doi.org/10.1080/13548506.2016.1160134>

Miettinen, T. A., Huttunen, J. K., Naukkarinen, V., Strandberg, T., Mattila, S., Kumlin, T., & Sarna, S. (1985). Multifactorial primary prevention of cardiovascular diseases in middle-aged men. *Journal of the American Medical Association*, 254(2), 2097–2102.

- Milanovic, Z., Pantelic, S., Trajkovic, N., Sporis, G., Kostic, R., & James, N. (2013). Age-related decrease in physical activity and functional fitness among elderly men and women. *Clinical Intervention on Aging*, 8, 549-556. doi: 10.2147/CIA.S44112
- Mitnitski, A., Mogliner, A., & Rockwood, K. (2001). Accumulation of deficits as a proxy measure of aging. *Scientific World Journal*, 1 (8), 323-336.
- Mo, P. K. H., Chong, E. S. K., Mak, W. W. S., Wong, S. Y. S., & Lau, J. T. F. (2016). Physical activity in people with mental illness in Hong Kong: Application of the health belief model. *Journal of Sport and Exercise Psychology*, 38(2), 203–208.  
<https://doi.org/10.1123/jsep.2015-0061>
- Moran, A. E., Roth, G. A., Narula, J., & Mensah, G. A. (2014). 1990-2010 Global cardiovascular disease atlas. *Global Heart*, 9(1), 3–16. <https://doi.org/10.1016/j.ghheart.2014.03.1220>
- Moreno, J. P., & Johnston, C. A. (2014). Barriers to physical activity in women, *American Journal of Lifestyle Medicine*, 8(3), 164–166. <https://doi.org/10.1177/1559827614521954>.
- Mosca, L., Barrett-Connor, E., & Wenger, N.K. (2011). Sex/gender differences in cardiovascular disease prevention: What a difference a decade makes. *Circulation*, 124(19), 2145–2154.  
<https://doi.org/10.1161/CIRCULATIONAHA.110.968792>
- Mosca, L., Hammond, G., Mochari-Greenberger, H., Towfighi, A., & Albert, M. A. (2013). Fifteen-year trends in awareness of heart disease in women: Results of a 2012 American heart association national survey. *Circulation*, 127(11), 1254–1263.  
<https://doi.org/10.1161/CIR.0b013e318287cf2f>
- Mozaffarian, D., Benjamin, E. J., Go, A. S., Arnett, D. K., Blaha, M. J., Cushman, M., ... Turner, M. B. (2016). AHA Statistical update executive summary : Heart disease and stroke

statistics — 2016 update a report from the american heart association. *Circulation*, 2016 (133), 447–454. <https://doi.org/10.1161/CIR.0000000000000366>

Munro, S., Lewin, S., Swart, T., & Volmink, J. (2007). A review of health behaviour theories: How useful are these for developing interventions to promote long-term medication adherence for TB and HIV/AIDS? *BMC Public Health*, 7, 1–16. <https://doi.org/10.1186/1471-2458-7-104>

Murphy, N., Alderman, P., Voegelé, K., & Harris, N. (2017). Women and heart disease: An evidence-based update. *Journal for Nurse Practitioners*, 13(9), 610–616. <https://doi.org/10.1016/j.nurpra.2017.07.011>

Murray, T. C., Rodgers, W. M., & Fraser, S. N. (2012). Exploring the relationship between socioeconomic status, control beliefs and exercise behavior: A multiple mediator model. *Journal of Behavioral Medicine*, 35(1), 63–73. <https://doi.org/10.1007/s10865-011-9327-7>

Myers, J. (2003). Exercise and Cardiovascular Health. *Circulation*, 107(1), 2e–5. <https://doi.org/10.1161/01.CIR.0000048890.59383.8D>

Myers, Mcauley, Lavie, Despres, Arena, & Kokkinos. (2015). Physical activity and cardiorespiratory fitness as major markers of cardiovascular risk: Their independent and interwoven importance to health status. *Progress in Cardiovascular Diseases*, 57(4), 306–314.

Nabi, H., Hall, M., Koskenvuo, M., Singh-Manoux, A., Oksanen, T., Suominen, S., ... Vahtera, J. (2010). Psychological and somatic symptoms of anxiety and risk of coronary heart disease: The health and social support prospective cohort study. *Biological Psychiatry*, 67(4), 378–385. <https://doi.org/10.1016/j.biopsych.2009.07.040>

- Nader, P. R., Baranowski, T., Vanderpool, N. A., Dunn, K., Dworkin, R., & Ray, L. (1983). The family health project: cardiovascular risk reduction education for children and parents. *Journal of Developmental and Behavioral Pediatrics, 4*(1), 3–10.
- Newton, S., Braithwaite, D., & Akinyemiju, T. (2017). Socio-economic status over the life course and obesity: systematic review and meta-analysis. *Plos One, 12* (5). doi: 10.1371/journal.pone.01771151.
- Nowak, Z., Plewa, M., Skowron, M. . . . Osiadlo, G. (2010). Paffenbarger Physical Activity Questionnaire as a additional tool in clinicla assessment of patients with coronary artery disease treated with angioplasty. *Kardiologia Polska, 68*(1), 32-39.
- Nunes, B., Thume, E., Tomase, E., Duro, S., & Facchini, L. (2014). Socioeconomic inequalities in the access to and quality of health care services. *Revista de Saude Publica, 48* (6), 968-976. doi: 10.1590/S0034-8910.2014048005388.
- O’Neil, A., Fisher, A. J., Kibbey, K. J., Jacka, F. N., Kotowicz, M. A., Williams, L. J., . . . Pasco, J. A. (2016). Depression is a risk factor for incident coronary heart disease in women: An 18-year longitudinal study. *Journal of Affective Disorders, 196*, 117–124.  
<https://doi.org/10.1016/j.jad.2016.02.029>
- Ogden, C., Curtin, L., McDowell, M., Tabak, C., & Flegal, K. (2008). Prevelance of overweight and obesity in the United States, 1999-2004. *Journal of the American Medical Association, 295* (13), 1549-55.
- Oguma, Y., & Shinoda-Tagawa, T. (2004). Physical activity decreases cardiovascular disease risk in women: Review and meta-analysis. *American Journal of Preventive Medicine, 26*(5), 407–418. <https://doi.org/10.1016/j.amepre.2004.02.007>

- Olander, E., Fletcher, H., Williams, S., Atkinson, L., Turner, A., & French, D. (2013). What are the most effective techniques in changing obese individuals' physical activity self-efficacy and behavior: a systematic review and meta-analysis. *International Journal of Behavior Nutrition and Physical Activity*, 10–29. <https://doi.org/10.1186/1479-5868-10-29>
- Ong, P., Lovasi, G. S., Madsen, A., Van Wye, G., & Demmer, R. T. (2017). Evaluating the effectiveness of New York City health policy initiatives in reducing cardiovascular disease mortality, 1990–2011. *American Journal of Epidemiology*, 12(3), 1–9. <https://doi.org/10.1093/aje/kwx134>
- Ostwald, S. K. (1989). Changing employees' dietary and exercise practices: an experimental study in a small company. *Journal of Occupational Medicine*, 31(2), 90–97.
- Ottawa Charter for Health Promotion. (1986). *Health promotion (Oxford)*, 1(4)
- Overgaard, J., Larsen, C., Holtze, S., Ockholm, K., & Kristensen, M. (2017). Interrater reliability of the 6-minute walk test in women with hip fracture. *Journal of Geriatric Physical Therapy*, 40(3), 158–166. doi: 10.1519/JPT.0000000000000088
- Oyemi, A., & Adeyemi, O. (2013). Relationship of physical activity to cardiovascular risk factors in an urban population of Nigerian adult. *Archives of Public Health*, 71(1), 6. doi: 10.1186.0778-7367-71-6.
- Paine, N. J., Bacon, S. L., Pelletier, R., Arsenault, A., Diodati, J. G., & Lavoie, K. L. (2016). Do women with anxiety or depression have higher rates of myocardial ischemia during exercise testing than men? *Circulation: Cardiovascular Quality and Outcomes*, 9(suppl), S53–S61. <https://doi.org/10.1161/CIRCOUTCOMES.115.002491>
- Pender, N. J. (2015). *Health promotion in nursing practice*. (C. L. Murdaugh & M. A. Parsons,

Eds.) (7th ed). Boston, MA : Pearson.

Perrin, A. (1997). Self-efficacy in changing societies - Bandura,A. *Journal of Developmental & Behavioral Pediatrics, 18*(4), 280. <https://doi.org/10.1097/00004703-199708000-00010>

Perry, C. K., Rosenfeld, A. G., Bennett, J. A., & Potempa, K. (2007). Heart-to-Heart: promoting walking in rural women through motivational interviewing and group support. *The Journal of Cardiovascular Nursing, 22*(4), 304–312.

<https://doi.org/10.1097/01.JCN.0000278953.67630.e3>

Philippou, C., Papandreou, D., Hadjigeorgiou, P., Charidemou, E., Georgaki, E., Andreou, C., ...

Andreou, E. (2018). The association of physical activity to blood cholesterol levels and blood pressure. *Clinical Nutrition, 24*(2018), 188–189.

<https://doi.org/10.1016/j.clnesp.2018.01.062>

Phillips, L. A., Chamberland, P. É., Hekler, E. B., Abrams, J., & Eisenberg, M. H. (2016).

Intrinsic rewards predict exercise via behavioral intentions for initiators but via habit strength for maintainers. *Sport, Exercise, and Performance Psychology, 5*(4), 352–364.

<https://doi.org/10.1037/spy0000071>

Phillips, L. A., & Gardner, B. (2016). Habitual exercise instigation (vs. execution) predicts

healthy adults' exercise frequency. *Health Psychology, 35*(1), 69–77.

<https://doi.org/10.1037/hea0000249>

Poirier, P., Giles, T. D., Bray, G. A., Hong, Y., Stern, J. S., Pi-Sunyer, F. X., & Eckel, R. H.

(2006). Obesity and cardiovascular disease: Pathophysiology, evaluation, and effect of weight loss: An update of the 1997 American Heart Association Scientific Statement on

obesity and heart disease from the Obesity Committee of the Council on Nutrition, Physical.

*Circulation*, 113(6), 898–918. <https://doi.org/10.1161/CIRCULATIONAHA.106.171016>

Polit, D., & Beck, Cheryl Tatano. (2012). *Nursing research: Generating and assessing evidence for nursing practice* / Denise F. Polit, Cheryl Tatano Beck. (9th ed.). Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.

Poortaghi, S., Baghernia, A., Golzari, S. E., Safayian, A., & Atri, S. B. (2013). The effect of home-based cardiac rehabilitation program on self efficacy of patients referred to cardiac rehabilitation center. *BMC Research Notes*, 6, 287. <https://doi.org/10.1186/1756-0500-6-287>

Paltopoulou, T., Hatzis, G., Papageorgious, N., Androulakis, E., Briasoulis, A., & Tousoulis, D. (2017). *Hellenic Journal of Cardiology*, 58(1), 32-42. doi: 10.1016/j.hjc.2017.01.022.

Radloff, L. (1977). The CES-D scale: a self-report depression scale for research in the general population. *Applied Psychological Measurement*, 1, 385-401.

Ramachandran, H. J., Wu, V. X., Kowitlawakul, Y., & Wang, W. (2016). Awareness, knowledge and healthy lifestyle behaviors related to coronary heart disease among women: An integrative review. *Heart & Lung: The Journal of Acute and Critical Care*, 45(3), 173–185. <https://doi.org/10.1016/j.hrtlng.2016.02.004>

Rasiah, R., Thangiah, G. Yusoff, K., Manikam, R., Chandrasekaran, S, Mustafa, R., & Bakar, N. (2015). The impace of physical activity on cumulative cardiovascular disease risk factors among Malyasian adults. *Biomed Central Health*, 16 (15), 1242. doi: 10.1186/s12889-015-25775.

Rejeski, W. J., Brawley, L. R., Ambrosius, W. T., Brubaker, P. H., Focht, B. C., Foy, C. G., & Fox, L. D. (2003). Older adults with chronic disease: benefits of group-mediated counseling

in the promotion of physically active lifestyles. *Health Psychology*, 22(4), 414–423.

Renner, B., Spivak, Y., Kwon, S., & Schwarzer, R. (2007). Does age make a difference?

Predicting physical activity of South Koreans. *Psychology and Aging*, 22(3), 482–493.

<https://doi.org/10.1037/0882-7974.22.3.482>

Resnick, B., Zimmerman, S. I., Orwig, D., Furstenberg, a L., & Magaziner, J. (2000). Outcome

expectations for exercise scale: utility and psychometrics. *The Journals of Gerontology.*

*Series B, Psychological Sciences and Social Sciences*, 55(6), S352–S356.

<https://doi.org/10.1093/geronb/55.6.S352>

Reynolds, H. R., Srichai, M. B., Iqbal, S. N., Slater, J. N., Mancini, G. B. J., Feit, F., ...

Hochman, J. S. (2011). Mechanisms of myocardial infarction in women without

angiographically obstructive coronary artery disease. *Circulation*, 124(13), 1414–1425.

<https://doi.org/10.1161/CIRCULATIONAHA.111.026542>

Rhodes, R. E., & Quinlan, A. (2015). Predictors of physical activity change among adults using

observational designs. *Sports Medicine*, 45(3), 423–441. [https://doi.org/10.1007/s40279-](https://doi.org/10.1007/s40279-014-0275-6)

[014-0275-6](https://doi.org/10.1007/s40279-014-0275-6)

Roberts, K. C., Rao, D. P., Bennett, T. L., Loukine, L., & Jayaraman, G. C. (2015). Prevalence

and patterns of chronic disease multimorbidity and associated determinants in Canada.

*Chronic Diseases and Injuries in Canada*, 35(6), 87–94.

<https://doi.org/10.24095/hpcdp.35.6.01>

Roderick, P. J., Brennan, P. J., & Meade, T. W. (1995). Do risk factors change in men at high

risk of coronary heart disease? Observations on the effect of health promotion in primary

care. *Journal of Cardiovascular Risk*, 2(4), 353–357.

- Rodgers, W. M., Markland, D., Selzler, A. M., Murray, T. C., & Wilson, P. M. (2014). Distinguishing perceived competence and self-efficacy: An example from exercise. *Research Quarterly for Exercise and Sport*, 85(4), 527–539. <https://doi.org/10.1080/02701367.2014.961050>
- Rodgers, W. M., Murray, T. C., Selzler, A.-M., & Norman, P. (2013). Development and impact of exercise self-efficacy types during and after cardiac rehabilitation. *Rehabilitation Psychology*, 58(2), 178–84. <https://doi.org/10.1037/a0032018>
- Rodgers, W. M., Murray, T. C., Wilson, P. M., Hall, C. R., & Fraser, S. N. (2008). Evidence for a multidimensional self-efficacy for exercise scale. *Research Quarterly for Exercise and Sport*, 79(2), 222–234. <https://doi.org/10.1080/02701367.2008.10599485>
- Rose, G., & Hamilton, P. J. (1978). A randomised controlled trial of the effect on middle-aged men of advice to stop smoking. *Journal of Epidemiology and Community Health*, 32(4), 275–281.
- Rose, G., Hamilton, P. J. S., Colwell, L., & Shipley, M. J. (1982). A randomised controlled trial of anti-smoking advice: 10-year results. *Journal of Epidemiology Community Health*, 36(2), 102.
- Rosenstock, I. M. (1974). Historical origins of the health belief model. *Health Education & Behavior*, 2(4), 328–335. <https://doi.org/10.1177/109019817400200403>
- Rosenstock, Irwin M., & Others. (1988). Social learning theory and the health belief model. *Health Education Quarterly*, 15(2), 175-83.
- Ross, R. M., Murthy, J. N., Wollak, I. D., & Jackson, A. S. (2010). The six minute walk test accurately estimates mean peak oxygen uptake. *BMC Pulmonary Medicine*, 10.

<https://doi.org/10.1186/1471-2466-10-31>

Rossouw, J., Anderson, G., Prentice, R., & LaCroix, A. (2002). Risks and benefits of estrogen plus progestin in healthy postmenopausal women: Principal results from the Women's Health Initiative Randomized Controlled Trial. *JAMA*, 288(3), 321-33.

Rundle-Thiele, S., Kubacki, K., & Gruneklee, N. (2016). Perceived benefits and barriers of physical activity: A social marketing formative study. *Health Marketing Quarterly*, 33(2), 181–194. <https://doi.org/10.1080/07359683.2016.1166872>

Saito, T., & Sadoshima, J. (2016). Molecular mechanisms of mitochondrial autophagy.mitophagy in the heart. *Circulation Research*, 116(8), 1477–1490.

<https://doi.org/10.1161/CIRCRESAHA.116.303790>

Sallis, Pinski, Grossman, Patterson, & Nader. (1988). The development of self-efficacy scales for health-related diet and exercise behaviors. *Health Education Research*, 3(3), 283-292.

Sanderson, B. K., Shewchuk, R. M., & Bittner, V. (2010). Cardiac Rehabilitation and Women. *Journal of Cardiopulmonary Rehabilitation and Prevention*, 30(1), 12–21.  
<https://doi.org/10.1097/HCR.0b013e3181c85859>

Schembre, A., Durand, C., Blissmer, B., & Greene, G. (2015). Development and validation of the cognitive behavioral physical activity questionnaire. *American Journal of Health Promotion*, 30 (1), 58-65.

Schenck-Gustafsson, K. (2009). Risk factors for cardiovascular disease in women. *Maturitas*, 63(3), 186–190. <https://doi.org/10.1016/j.maturitas.2009.02.014>

Schneider, J. K., Cook, J. H., & Luke, D. A. (2011). Unexpected effects of cognitive-behavioural therapy on self-reported exercise behaviour and functional outcomes in older adults. *Age*

*and Ageing*, 40(2), 163–168. <https://doi.org/10.1093/ageing/afq137>

Sergi, G., Veronese, N., Fontana, L., De Rui, M., Bolzetta, F., Zambon, S., ... Manzato, E.

(2015). Pre-frailty and risk of cardiovascular disease in elderly men and women: The Pro.V.A. Study. *Journal of the American College of Cardiology*, 65(10), 976–983.

<https://doi.org/10.1016/j.jacc.2014.12.040>

Shai, I., Rimm, E. B., Hankinson, S. E., Curhan, G., Manson, J. A. E., Rifai, N., ... Ma, J.

(2004). Multivariate assessment of lipid parameters as predictors of coronary heart disease among postmenopausal women: Potential implications for clinical guidelines. *Circulation*, 110(18), 2824–2830. <https://doi.org/10.1161/01.CIR.0000146339.57154.9B>

Shin, H., Shin, J., Liu, P. Y., Dutton, G. R., Abood, D. A., & Ilich, J. Z. (2011). Self-efficacy improves weight loss in overweight/obese postmenopausal women during a 6-month weight loss intervention. *Nutrition Research*, 31(11), 822–828.

<https://doi.org/10.1016/j.nutres.2011.09.022>

Simons-Morton, B. G. (2012). *Behavior theory in health promotion practice and research*. Burlington, MA: Jones & Bartlett Learning.

Smith, G., Banting, L., Eime, R., O’Sullivan, G., & Van Uffelen, J. (2017). The association between social support and physical activity in older adults: A systematic review. *The International Journal of Behavioral Nutrition and Physical Activity*, 14(1),

Smith-Dijulio, K., & Anderson, D. (2009). Sustainability of a multimodal intervention to promote lifestyle factors associated with the prevention of cardiovascular disease in midlife Australian women: A 5-year follow-up. *Health Care for Women International*, 30(12), 1111–1130. <https://doi.org/10.1080/07399330903104524>

Soares-Miranda, L., Siscovick, D. S., Psaty, B. M., Longstreth, W. T., & Mozaffarian, D. (2016).

Physical activity and risk of coronary heart disease and stroke in older adults. *Circulation*, *133*(2), 147–155. <https://doi.org/10.1161/CIRCULATIONAHA.115.018323>

Srof, B. J., & Velsor-Friedrich, B. (2006). Health promotion in adolescents: A review of

Pender's health promotion model. *Nursing Science Quarterly*, *19*(4), 366–373.

<https://doi.org/10.1177/0894318406292831>

Stachowiak, G., Pertyński, T., & Pertyńska-Marczewska, M. (2015). Metabolic disorders in

menopause. *Przegląd Menopauzalny*, *14*(1), 59–64. <https://doi.org/10.5114/pm.2015.50000>

Staessen, J., Bulpitt, C. J., Fagard, R., Joossens, J. V, Lijnen, P., & Amery, A. (1988). Salt intake

and blood pressure in the general population: A controlled intervention trial in two towns.

*Journal of Hypertension*, *6*(12), 965–973.

Statistics Canada (2011). Table 105-0501. Overweight and obese adults (self-reported).

Retrieved from <https://www150.statcan.gc.ca/n1/pub/82-625-x/2012001/article/11664-eng.htm>

Statistics Canada.(2015). Directly measured physical activity of adults, 2012 and 2013.

Retrieved from <https://www.statcan.gc.ca/pub/82-625-x/2015001/article/14135-eng.htm>

Statistics Canada (2016). Education in Canada. Key results from the 2016 census. Retrieved

from <https://www150.statcan.gc.ca/n1/daily-quotidien/171129/dq171129a-eng.htm>

Statistics Canada. (2016). Families, households, and marital status. Key results from the 2016

census. Retrieved from [https://www150.statcan.gc.ca/n1/daily-](https://www150.statcan.gc.ca/n1/daily-quotidien/170802/dq170802a-eng.htm)

[quotidien/170802/dq170802a-eng.htm](https://www150.statcan.gc.ca/n1/daily-quotidien/170802/dq170802a-eng.htm)

Statistics Canada. (2016). Table 13-10-0096-13. Physical activity, self reported, adult, by age

Retrieved from <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310009613>

Steinhardt, M. A., & Dishman, R. K. (1989). Reliability and validity of expected outcomes and barriers for habitual physical activity. *Journal of Occupational and Environmental Medicine*. <https://doi.org/10.1097/00043764-198906000-00011>

Stenholm, S., Solovieva, S., Viikari-Juntura, E., Aalto, V., Kivimäki, M., & Vahtera, J. (2017).

Change in body mass index during transition to statutory retirement: An occupational cohort study. *International Journal of Behavioral Nutrition and Physical Activity*, *14*(1), 1–8.

<https://doi.org/10.1186/s12966-017-0539-2>

Stewart, A. L., Mills, K. M., Sepsis, P. G., King, A. C., McLellan, B. Y., Roitz, K., & Ritter, P. L. (1997). Evaluation of CHAMPS, a physical activity promotion program for older adults. *Annals of Behavioral Medicine*, *19*(4), 353–361.

Strachan, S. M., Perras, M. G. M., Brawley, L. R., & Spink, K. S. (2016). Exercise in challenging times: The predictive utility of identity, self-efficacy, and past exercise. *Sport, Exercise, and Performance Psychology*, *5*(3), 247–258. <https://doi.org/10.1037/spy0000064>

Stretcher, V. and Rosenstock, I.M. (1997). The Health Belief Model. In Glanz, K., Lewis, F.M. and Rimer, B.K., (Eds.). *Health Behaviour and Health Education: Theory, Research and Practice*. San Francisco: Jossey-Bass.

Sunyer, X., Blackburn, G., Brancati, F., Bray, G., Bright, R., Clark, J., . . . Yanovski, S. (2007). Reduction in weight and cardiovascular disease risk factors in individuals with type 2 diabetes: One-year results of the look AHEAD trial. *Diabetes Care*, *30*(6), 1374-83.

Sutton, E. J., Rolfe, D. E., Landry, M., Sternberg, L., & Price, J. A. D. (2012). Cardiac rehabilitation and the therapeutic environment: The importance of physical, social, and

symbolic safety for programme participation among women. *Journal of Advanced Nursing*, 68(8), 1834–1846. <https://doi.org/10.1111/j.1365-2648.2012.06041.x>

Sweet, S. N., Tulloch, H., Fortier, M. S., Pipe, A. L., & Reid, R. D. (2011). Patterns of motivation and ongoing exercise activity in cardiac rehabilitation settings: A 24-month exploration from the TEACH study. *Annals of Behavioral Medicine*, 42(1), 55–63. <https://doi.org/10.1007/s12160-011-9264-2>

Tappe, K. A., & Glanz, K. (2013). Measurement of exercise habits and prediction of leisure-time activity in established exercise. *Psychology, Health and Medicine*, 18(5), 601–611. <https://doi.org/10.1080/13548506.2013.764458>

Tavakoly Sany, S. B., Peyman, N., Behzad, F., Esmaeily, H., Taghipoor, A., & Ferns, G. (2017). Health providers' communication skills training affects hypertension outcomes. *Medical Teacher*, 0(0), 1–10. <https://doi.org/10.1080/0142159X.2017.1395002>

Telama, R. (2009). Tracking of physical activity from childhood to adulthood: A review. *Obesity Facts*, 2(3), 187–195. <https://doi.org/10.1159/000222244>

Teychenne, M., Ball, K., & Salmon, J. (2008). Physical activity and likelihood of depression in adults: A review. *Preventive Medicine*, 46(5), 397–411. <https://doi.org/10.1016/j.ypmed.2008.01.009>

Thomas, Hart, & Burman. (2014). Improving health promotion and disease prevention in NP-delivered primary care. *The Journal for Nurse Practitioners*, 10(4), 221-228.

Tsao, C., & Vasan, R. (2015). The Framingham Heart Study: Past, present and future. *International Journal of Epidemiology*, 44(6), 1763-1766.

Tsui, J. I., Dodson, K., & Jacobson, T. A. (2004). Cardiovascular disease prevention counseling

- in residency: Resident and attending physician attitudes and practices. *Journal of the National Medical Association*, 96(8), 1080–3, 1088–91.
- Trost, S., Pate, R., Sallis, J., Freedson, P., Taylor, W., Dowda, M., & Sirard, J. (2002). Age and gender differences in objectively measured physical activity in youth. *Medicine And Science In Sports And Exercise*, 34(2), 350-355.
- Tuck, N. L., Adams, K. S., Pressman, S. D., & Consedine, N. S. (2017). Greater ability to express positive emotion is associated with lower projected cardiovascular disease risk. *Journal of Behavioral Medicine*, 1–9. <https://doi.org/10.1007/s10865-017-9852-0>
- Vaccarino, V., Abramson, J. L., Veledar, E., & Weintraub, W. S. (2002). Sex differences in hospital mortality after coronary artery bypass surgery: Evidence for a higher mortality in younger women. *Circulation*, 105(10), 1176–1181. <https://doi.org/10.1161/hc1002.105133>
- Vanden Bosch, M. L., Robbins, L. B., & Anderson, K. (2015). Correlates of Physical Activity in Middle-Aged Women With and Without Diabetes. *Western Journal of Nursing Research*, 37(12), 1581–1603. <https://doi.org/10.1177/0193945914541333>
- Ventura, M. R., Young, D. E., Feldman, M. J., Pastore, P., Pikula, S., & Yates, M. A. (1984). Effectiveness of health promotion interventions. *Nursing Research*, 33(3), 162–167.
- Verma, G., O’Laughlin, J., Bunker, L., Peterson, S., & Frishman, W. (2017). Trial of time: review of frailty and cardiovascular disease. *Cardiology Review*, 25(5), 236-240. doi: 10.1097/CRD.000000000000152
- Veronese, N., Cereda, E., Stubbs, B., Solmi, M., Luchini, C., Manzato, E., ... Correll, C. U. (2017). Risk of cardiovascular disease morbidity and mortality in frail and pre-frail older adults: Results from a meta-analysis and exploratory meta-regression analysis. *Ageing*

*Research Reviews*, 35, 63–73. <https://doi.org/10.1016/j.arr.2017.01.003>

Verplanken, B., & Melkevik, O. (2008). Predicting habit: the case of physical exercise.

*Psychology of Sports Exercise*, 9(1), 15-26

<https://doi.org/10.1016/j.psychsport.2007.01.002>

Warburton, D., Nicol, C., & Bredin, S. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal*, 174(6), 801-809.

Webster, R., & Heeley, E. (2010). Perceptions of risk: understanding cardiovascular disease.

*Risk Management Healthcare Policy*, 3, 49-60. doi: 10.2147/RMHP.S8288

Wenger, N., Speroff, L., & Packard, B. (1993). Cardiovascular health and disease in women. *The New England Journal of Medicine*, 329(4), 247-256.

Wenger, N. K. (2012). Women and coronary heart disease: A century after herrick:

Understudied, underdiagnosed, and undertreated. *Circulation*, 126(5), 604–611.

<https://doi.org/10.1161/CIRCULATIONAHA.111.086892>

Wenger, N. K. (2015). Transforming cardiovascular disease prevention in women: Time for the pygmalion construct to end. *Cardiology*, 130(1), 62–68. <https://doi.org/10.1159/000370018>

Whelton, S. P., Chin, A., Xin, X., & Jiang, H. (2002). Effect of aerobic exercise on blood pressure: A meta-analysis of randomized, controlled trials. *Annals of Internal Medicine*, 136(7), 493–503.

Wilcox, S., Castro, C. M., & King, A. C. (2006). Outcome expectations and physical activity participation in two samples of older women. *Journal of Health Psychology*, 11(1), 65–77.

<https://doi.org/10.1177/1359105306058850>

Wilson, P. W. F., D'Agostino, R. B., Sullivan, L., Parise, H., & Kannel, W. B. (2002).

- Overweight and obesity as determinants of cardiovascular risk. *Archives of Internal Medicine*, 162(16), 1867. <https://doi.org/10.1001/archinte.162.16.1867>
- Wizemann, T., & Pardue, M. (2001). Exploring the biological contributions to human health: does sex matter? *Journal of Women's Health & Gender-Based Medicine*, 10(5), 433–439. <https://doi.org/10.1089/152460901300233902>
- Wójcicki, T. R., White, S. M., & McAuley, E. (2009). Assessing outcome expectations in older adults: The multidimensional outcome expectations for exercise scale. *Journals of Gerontology*, 64(1), 33–40. <https://doi.org/10.1093/geronb/gbn032>
- Woodard, G. A., Brooks, M. M., Barinas-Mitchell, E. H., Mackey, R., Matthews, K., & Sutton-Tyrrell, K. (2011). Lipids, menopause, and early atherosclerosis in Study of Women's Health Across the Nation Heart women. *Menopause*, 18(4), 376-384.
- Woodgate, J., & Brawley, L. R. (2008). Use of an efficacy-enhancing message to influence the self-regulatory efficacy of cardiac rehabilitation participants: A field experiment. *Rehabilitation Psychology*, 53(2), 153–161. <https://doi.org/10.1037/0090-5550.53.2.153>
- Woodgate, J., Brawley, L. R., & Weston, Z. J. (2005). Maintenance cardiac rehabilitation exercise adherence. *Journal of Applied Social Psychology*, 35(1), 183–197.
- Woodruff, R. C., Raskind, I. G., Ballard, D., Battle, G., Haardörfer, R., & Kegler, M. C. (2017). Weight-related perceptions and experiences of young adult women in Southwest Georgia. *Health Promotion Practice*, 19(1), 125-133. <https://doi.org/10.1177/1524839916688868>
- Woollard, J., Burke, V., Beilin, L. J., Verheijden, M., & Bulsara, M. K. (2003). Effects of a general practice-based intervention on diet, body mass index and blood lipids in patients at cardiovascular risk. *Journal of Cardiovascular Risk*, 10(1), 31–40.

<https://doi.org/10.1097/01.hjr.0000050718.61003.30>

World Health Organization (2018). *Global strategy on diet, physical activity and health*.

Retrieved from <http://www.who.int/dietphysicalactivity/pa/en/>

World Health Organization (2017). *Health promotion and disease prevention through population-based interventions, including action to address social determinants and health inequity*. Retrieved from <http://www.emro.who.int/about-who/public-health-functions/health-promotion-disease-prevention.html>

World Health Organization (2018). *The Ottawa health charter for health promotion*. Retrieved from <http://www.who.int/healthpromotion/conferences/previous/ottawa/en/>

Wyman, L., Crum, R. M., & Celentano, D. (2012). Depressed mood and cause-specific mortality: A 40-year general community assessment. *Annals of Epidemiology*, 22(9), 638–643. <https://doi.org/10.1016/j.annepidem.2012.06.102>

Xia, N. & Li, H. (2016). Loneliness, social isolation, and cardiovascular health. *Antioxidants and Redox Signaling*, 28,(9), 837-851. doi: 10.1089/ars.2017.7312

Yang, S. O., Jeong, G. H., Kim, S. J., & Lee, S. H. (2014). Correlates of Self-Care Behaviors among Low-Income Elderly Women with Hypertension in South Korea. *JOGNN - Journal of Obstetric, Gynecologic, and Neonatal Nursing*, 43(1), 97–106. <https://doi.org/10.1111/1552-6909.12265>

Yusuf, S., Hawken, S., Ôunpuu, S., Dans, T., Avezum, A., Lanas, F., ... Lisheng, L. (2004). Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries in a case-control study based on the INTERHEART study. *Lancet*, 364, 937–952. [https://doi.org/10.1016/S0140-6736\(04\)17018-9](https://doi.org/10.1016/S0140-6736(04)17018-9)

Zimlichman, R., Shargorodsky, M., Boaz, M., Duprez, D., Rahn, K. H., Rizzoni, D., ...

McVeigh, G. (2005). Determination of arterial compliance using blood pressure waveform analysis with the CR-2000 system: Reliability, repeatability, and establishment of normal values for healthy European population - The seven european sites study (SESS). *American Journal of Hypertension*, 18(1), 65–71. <https://doi.org/10.1016/j.amjhyper.2004.08.013>

**LIST OF APPENDICES**

- Appendix A      The General Self-Efficacy Scale
- Appendix B      The Multidimensional Self-Efficacy for Exercise Scale
- Appendix C      Rasmussen 4-Test Protocol
- Appendix D      International Physical Activity Questionnaire
- Appendix E      5 meter walk test and 6-Minute Walk Test Instructions
- Appendix F      Outcome Expectations Questionnaire

## Appendix A

**THE GENERAL SELF-EFFICACY SCALE**

For each of the following statements, please circle the choice that is closest to how true you think it is for you. The questions ask about your opinion. There are no right or wrong answers.

<b>“IN MY OPINION”</b>		<b>Not at all true</b>	<b>Hardly true</b>	<b>Moderately true</b>	<b>Exactly true</b>
<b>1</b>	I can always manage to solve difficult problems if I try hard enough	1	2	3	4
<b>2</b>	If someone opposes or is against me, I can find a way to get what I want.	1	2	3	4
<b>3</b>	It is easy for me to stick to my aims and accomplish my goals.	1	2	3	4
<b>4</b>	I am confident that I could deal efficiently with unexpected events	1	2	3	4
<b>5</b>	Thanks to my resourcefulness, I know how to handle unexpected or unforeseen situations.	1	2	3	4
<b>6</b>	I can solve most problems if I invest the necessary effort.	1	2	3	4
<b>7</b>	I can remain calm when facing difficulties because I can rely on my coping abilities.	1	2	3	4
<b>8</b>	When I am confronted with a problem, I can usually find several solutions	1	2	3	4
<b>9</b>	If I am in trouble, I can usually think of a solution.	1	2	3	4
<b>10</b>	I can usually handle whatever comes my way.	1	2	3	4

**Scoring Explanation:**

➤ Scores range from “Not at all true” (1) to “exactly true” (4).

**Appendix B**

**THE MULTI-DIMENSIONAL SELF-EFFICACY FOR EXERCISE SCALE**

For each of the following nine questions, please respond based on how confident you are that you can accomplish this task

How confident are you that you can:		Please circle the best response										
		Not Confident at all										Extremely Confident
1.	Complete your exercise using proper technique	0	1	2	3	4	5	6	7	8	9	10
2.	Follow directions to complete exercise	0	1	2	3	4	5	6	7	8	9	10
3.	perform all of the required movements	0	1	2	3	4	5	6	7	8	9	10
4.	exercise when you feel discomfort	0	1	2	3	4	5	6	7	8	9	10
5.	exercise when you lack energy	0	1	2	3	4	5	6	7	8	9	10
6.	exercise when you don't feel well	0	1	2	3	4	5	6	7	8	9	10
7.	include exercise in your daily routine	0	1	2	3	4	5	6	7	8	9	10
8.	consistently exercise three times per week	0	1	2	3	4	5	6	7	8	9	10
9.	arrange your schedule to include regular exercise	0	1	2	3	4	5	6	7	8	9	10

\*Note code: task efficacy = questions 1-3; coping efficacy = questions 4-6; scheduling efficacy = questions 7-9).

\*Scores range from "Not confident at all" (1) to extremely confident (5).

\*From Rodgers et al., 2008

\*Note code: task efficacy = questions 1-3; coping efficacy = questions 4-6; scheduling efficacy = questions 7-9).

\*Scores range from "Not confident at all" (1) to extremely confident (5).

\*From Rodgers et al., 200

**Appendix C****Rasmussen - 4-test Protocol**

**Large artery elasticity (C1):** Value (mL/mm Hg x10): \_\_\_\_\_

**Small artery elasticity (C2):** Value (mL/mm Hg x100): \_\_\_\_\_

**Resting blood pressure:** Value (mmHg): Systolic: \_\_\_\_\_  
(Lowest value taken)

Value (mmHg): Diastolic: \_\_\_\_\_

**Blood pressure activity response:** Value (mmHg): Systolic: \_\_\_\_\_

**Exercise BP difference:** Activity Systolic - Resting Systolic: \_\_\_\_\_

## Appendix D

### International Physical Activity Questionnaire

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

\_\_\_\_\_ **days per week**

No vigorous physical activities      **→** *Skip to question 3*

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

\_\_\_\_\_ **hours per day**

\_\_\_\_\_ **minutes per day**

Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

\_\_\_\_\_ **days per week**

No moderate physical activities      **→** *Skip to question 5*

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

\_\_\_\_\_ **hours per day**

\_\_\_\_\_ **minutes per day**

Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

\_\_\_\_\_ **days per week**

No walking → *Skip to question 7*

6. How much time did you usually spend **walking** on one of those days?

\_\_\_\_\_ **hours per day**

\_\_\_\_\_ **minutes per day**

Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

\_\_\_\_\_ **hours per day**

\_\_\_\_\_ **minutes per day**

Don't know/Not sure

## Appendix E

### 5 meter walk test and 6-Minute Walk Test Instructions

**The following equipment is required for both tests:**

- Stopwatch for 5-meter walk test and timer for 6-minute walk test
- Recording sheet
- pencil/pen, clipboard
- Pylons and measuring wheel for 5-meter walk test
- Access to a chair(s) that can be easily moved along the walking course
- Place 5-meter walk test locations using pylons/tape on the long hallway approximately apart (16.4 feet = 5 meters)

**Patient preparation:**

- Participants should use their walking aids (i.e. cane, walker) during the test
- Participant's usual medical regimen should be followed
- “warm-up” should not be performed

Get participant to walk at normal speed from start to finish (5-meters)

*Time starts with first foot plant after starting line and ends with foot plant past stopping line*

**Before the 6 minute walk test:**

**Instruct the participant by saying:**

"The object of this test is to walk as far as possible for 6 minutes. You will be walking around the track. Six minutes is a long time to walk, so you will be exerting yourself. You may get out of breath or become exhausted. You are permitted to slow down, to stop, and to rest as necessary. You may lean against the wall while resting, but resume walking as soon as you are able.

**During the test:**

Position participant at starting point of 30 meter course -

Start the timer when participant starts to walk

- Use an even tone voice and give words of encouragement
- Record each lap with either a lap counter or mark down the laps on the worksheet
- Inform the participant on how much time is left at each minute, then every 15 seconds at the last minute.
- Instruct the participant to stop at the end of six minutes. You may want to bring the moveable chair to the participant to have a seat after the test. Record remaining feet with measuring wheel between quarter markings.

Date: \_\_\_\_\_

**5-Meter Walk Test**

Time to walk 5 meters (seconds)

Trial 1: \_\_\_\_\_ Trial 2: \_\_\_\_\_ Trial 3: \_\_\_\_\_

Average: \_\_\_\_\_

14.3 Were the walking tests performed with a walking aid (e.g. cane, walker, IV pole)?

No 0 Yes 1

**6-Minute Walk Test**

Complete laps: \_\_\_\_\_

Remaining meters: \_\_\_\_\_

Lap length = \_\_\_\_\_ (m)

**Total distance covered (meters):** \_\_\_\_\_

Medications taken before the test (dose and time): \_\_\_\_\_

Stopped or paused before 6 minutes? No Yes, reason: \_\_\_\_\_

Additional comments/symptoms:

**Appendix F**

**OUTCOMES EXPECTATIONS QUESTIONNAIRE\***

During the next 6 months, if I adhere to an exercise routine on a weekly basis, it will definitely: <i>(please check the appropriate box for each question)</i>					
	Strongly disagree	Disagree somewhat	Neither agree or disagree	Agree somewhat	Strongly agree
	1	2	3	4	5
a. get me in shape					
b. make me feel energetic					
c. make me feel more confident in doing everyday activities					
d. make me feel better than I do now					
e. decrease my risk of heart problems					
f. help me incorporate physical activity into my lifestyle					
g. achieve/maintain optimal weight					

\*Blanchard, Arthur, & Gunn (2015). With permission.

Blanchard, C., Arthur, H.M., & Gunn, E. (2015). Self-efficacy and outcome expectations in cardiac rehabilitation: associations with women’s physical activity. *Rehabilitation Psychology, 60*(1). 59-66. DOI: 10.1037/rep0000024.